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Section of the History of Medicine

President—Sir StClair Thomson, M.D.

[*October 3, 1934*]

Apothecaries in England in the Thirteenth Century

By C. J. S. Thompson, M.B.E.

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THE earliest record of an apothecary in England hitherto known by name is of John le Spicer, who was Mayor of York in 1273. Recent research among the State Papers has, however, now revealed three others whose names have not previously been recorded, who flourished from 1264 to 1265. They are Robert de Monte Pesolano (Montpellier) of Westminster, Philip of the Abbey of the Holy Cross, Gloucester, and Reginald of Hereford. Their names occur in connexion with a series of bills or accounts for drugs and preparations supplied, together with the quantities and prices. Two at least of them appear to have been attached to certain monastic institutions during the reign of Henry III, about the middle of the thirteenth century.

The first document that concerns us consists of a series of seven accounts for electuaries, &c., rendered by Robert de Pesolano in March at the " Feast of the Epiphany " in the twenty-ninth year of the reign of Henry III, about 1264.

Robert, who was a Frenchman, was apparently attached to the Abbey of Westminster. The following is a transcription of his accounts:—

Electuria de Roberto de Monte Pesolano.[1]

Dyazingib.	lb VII	dim.	pce	VIs	IIId
Pulvis Albi.	lb VIII	dim.	„	VIs	VIIId
Stomacico.	lb VI		„	Vs	

II

Pulv. Albi.	lb XVIII	dim.	pce	Vs	VIIId
Dyacitomiton.	lb VIII		„	VIs	VIIId
Gran.	lb VI		„	XVIIId	
Lycor.	lb VI		„	XVIIId	

III

Dyagalanga.	lb	pri	IIIs	IIIId
Cyminat. Alex.	lb IIII	„	IIIs	IIIId
Stomacicon. fort.	lb II	„	XXd	
Pulvis Albi.	lb III	„	IIs	
Grana	lb IIII	„	XIId	
Gariof.		„	XXd	
Mac.		„	XVId	

IV

Pulvis Albi.	lb XI	pri	VIIs	IIIId
Dyazingib.	lb V dim.	„	IIIIs	VIId
Diatimin.	lb VI dim.	„	Vs Vd	
Stomatico.	lb X dim.	„	VIIIs IXd	
Gran.	lb VI	„	XVIIId	

V

Diaroddon	lb VI	pri	Vs	
Diantimini	lb X	„	VIIIs IIIId	
Licor.	lb IIII	„	XIId	
Diazingeberis	lb VI dim.	„	Vs Vd	
Pulvis Albi	lb III	„	IIs	
Resupt.	lb IIII	„	VIs	

[1] British Museum, State Papers, 25459.

VI

Gran.	lb VI	pri	XVIIId
Licor:	lb IIII	„	XIId
Rosat: Nv.	lb VII	„	Vs Xd
Triasandali	lb VI dim.	„	Vs Vd
Dyantos	lb VI	„	Vs

VII

Stomaticon	lb IIII		pri	IIIs IXd
Triasandali	lb V	dim.	„	IVs VIId
Diarodon	lb V		„	IIIIs IId
Diantos	lb V		„	IIIIs VIId
Zucar Alex.	lb V		„	IIIs IId
Electuar: ad restaur.	lb VIII		„	VIIs Id
Rosat. n:	lb VI		„	Vs

The first account begins with three electuaries which were no doubt in common use as stomachics at that time and one of which, the Pulvis Albus, remained in the pharmacopœias of Europe until the eighteenth century. Dyazingib, which heads the list, was composed of ginger and honey, and Pulvis Albus of bezoar, coral, pearls, and crab's claws. Stomaticon consisted of a mixture of nutmeg, mace, coriander, anise, fennel, mint and liquorice.

In the second account we have Dyacitomiton in which wood-sorrel was an active ingredient, Grains of Paradise or Guinea pepper, and liquorice.

Dyagalanga, included in the third account, was an electuary made with galingal, an aromatic root often used as a condiment. It is mentioned by Ibn Khurdadbah, an Arab writer, in A.D. 869, and is thus alluded to by Chaucer in his "Canterbury Tales" :

> " To boil the chickens and the marrow bone
> And powder marchant tart and garlingale."

Following, there are Cumin of Alexandria, Stomacicon, Pulvis Albus, Grains of Paradise, Cloves and Mace.

In the fourth account, Pulvis Albus is followed by the electuaries of Ginger, Antimony, Stomaticon and Grains of Paradise.

The first item in the fifth account, Diarhodon, was composed of Rhubarb, Tartrate of Potash and Sugar. Liquorice, Electuary of Ginger and Pulvis Albus follows. "Resupt" or Electuary Resumptive was composed of Liquorice, Ground Ivy, Veronica, Coltsfoot, Raisins and Sweet Almonds.

In the sixth account, beyond the preparations previously mentioned, there are Trisandalum, an Electuary composed of the three varieties of Sandal Wood (red, white and yellow) and Dyantos, an Electuary of Aniseed.

In the seventh account there is a preparation not previously mentioned, viz., Restorative Electuary, which was composed of oxide of iron, carbonates of potash and lime, ginger and orange peel. It had a wide reputation as a tonic.

The next account is from Philip of Gloucester, an apothecary probably attached to the Abbey of the Holy Cross near that city.[2] The first item, viz., Diapenidion or Sugar Pennet, was a preparation similar to sugar candy and was made by boiling good white sugar with water until a thick syrup was formed. Into this, little sticks were dipped and allowed to crystallize which were called pennets, and after being softened, were drawn out into long ropes and dipped in olive oil. A piece was cut off and sucked to relieve a relaxed throat.

De Philippo Apothecar.
Gloucestr. Sancte Crucis
APUD Gloucestr.

Diapenidion	lb VII dim.	VIs IId
Grana	lb V	XVd

[2] British Museum, State Papers 25459.

The bill of Reginald, an apothecary of Hereford,[34] is a short one and consists of 4 pounds of strong stomaticon and grains of paradise.

De Reginaldo. Apoth. Hereford.

Stomaticon fort. lb IIII IIIIs
Gran.   lb XV IIIs IXd

The final document, which dates from the time of Edward I in 1279, is a bill from Odyn the Spicer.[4] It is of historical interest as it was for parcels of drugs supplied to the Queen during her illness at Westminster Palace on November 7 of that year.

The items are as follows : —

Particul. Odinetti Apothecarii. Parcels for Madame the Queen sold by Odyn the Spicer for her illness at Westminster the Seventh November.

I	lb	Mastiz.	IIs Vd
II	„	Diaguilon	XXd
½	„	Diante	Xd
½	„	Populion	Xd

XII. Nov.

Camomille	XIId
Miletot	Xd
Sauge	IId
Mauveo	IId
Guimmauves	XVd
Volule	XIIId
Calameti	VId

XIII. Nov.

I lb Diaquilon	Xd
I lb Populion	XXd

Nov. XVIII

½ lb Tamarinde	XXd
I quater Cass fistul	VId
Rose and Camemill	XXd
Ceire	XIId
Reysins	IIIId
I lb Rosat.	XIId
I lb Ceruse	XVId
I lb Densens	XIId
I lb Litarge	VIIId

XIX day of Month

V.	Maneres of erbes	IIs
XII	Boisces de plusur de maneres	Xd

XXII day of month

I ounce Mastic	IIIId
I ounce boile Armen	VId
VI Maneres of erbes	IIs
Oile rosat, violets and Camamille	XVId
II lb Eurose	XIId

XXIII day of month

Plusur maneres erbes	XIIIId

3 4 British Museum, State Papers 25459.

XXVII day of month

VII	Maneres de erbes	XIId
	Oile rosat	XIId
	Flowr of fewes, flow.	
	Orange	IIIId

Given with prices by the hand of
Philipe de Beauvays & Odin le Spicer.

According to the Wardrobe Rolls of 1313, Odyn held an official position at the Court of Edward II and received sevenpence-halfpenny a day as apothecary to the Queen.[5]   Among the least known drugs and preparations on the bill are Diaquilon (Confection of Aniseed) Diante (Electuary of Antimony) Populion (Poplar buds) Volvule (Black bird weed) Ceruse (White lead) Densens (Dandelion) Litarge (Lead oxide) Fewes flowr (Flowers of beans).

In connexion with these bills it may be interesting to recall the position of the apothecary in England in the fourteenth century.   Prior to 1428 the Apothecaries, Pepperers, and Spicers were branches of the same guild.   The first-named dealt in the drugs, gums, and aromatics used for medicinal purposes, which they also compounded, while the two latter chiefly traded in spices and condiments, mostly imported from abroad, that were mainly used for domestic purposes.   Before the fourteenth century the Apothecaries were associated with the Pepperers, who formed an influential body, or guild, and are mentioned in the Pipe Rolls as early as 1179. The Pepperers imported and regulated the sale of the drugs and various spices that came from the shores of the Red Sea, Arabia, and the Eastern ports.   In London they were the official custodians of the Standard weights, the Statern, or Steelyard, and the Balancia, or Scales, and were also keepers of the " Great Beam."

For trade convenience, as well as for mutual protection and support, members of the one guild usually settled in the same locality and so we find the Pepperers in London gathered about St. Antolin's Church at the junction of Soper's Lane (now Queen Street) with Watling Street, and in Budge Row in St. Thomas Apostle.   The Spicers congregated in the Ward of Chepe ; while the Apothecaries chiefly carried on their calling in the neighbourhood of Bucklersbury.   The Spicers, many of whom were Italians, sold their spices, condiments, and wax in the lanes off Cheapside, and paid a toll to the king in kind, consisting of a certain quantity of pepper annually. Their patron saint was St. Anthony and until the year 1373 they were also known as the Fraternity of St. Anthony.   The Pepperers, or Easterlings as they were sometimes called, were chiefly Germans from the Baltic coast and the Hanse towns who had settled in London, and imported Eastern produce and sold it to the Spicers and the Apothecaries.

Until about the end of the fourteenth century, the Apothecaries, Pepperers and Spicers continued to be branches of the same guild, and then, owing to jealousies that grew up between the various bodies, they divided.   These dissensions were mainly due to the competition between them caused by the sale of similar wares.   Thus, the Apothecaries accused the Spicers of adulterating their drugs, while on the other hand the Spicers charged the Apothecaries with similar malpractices.

In 1328, the Pepperers adopted the name Grossarii or grocers and the Spicers joined with them in forming the Company of Grocers, a body which was officially recognized and received its first Charter from Henry VI in 1428.   The apothecaries remained associated with the grocers until 1606, but in 1617 were granted a new Charter and incorporated into a separate Company by James I, which was afterwards known as the Society of Apothecaries.

Previous to the discovery of these documents, the earliest known record of an apothecary by name in England was in 1273, therefore we may conclude that Robert de Monte Pesolano, Philip of Gloucester and Reginald of Hereford who date from 1264, are the most ancient apothecaries of whom we have knowledge in this country.

[5] British Museum, Add. MSS. 4734.

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The Life and Medical Work of Maimonides

By W. M. FELDMAN, M.D., F.R.C.P.

MAIMONIDES, or Rabbi Moses ben Maimon, acrostically known as RAMBAM, was born in Cordova on March 30, 1135 and died in Cairo on December 13, 1204. His remains are interred at Tiberias in Palestine. A suitable epitaph on his tomb would be : *Per aspera ad astra* (" Through adversity to the stars "). He was of intellectually aristocratic descent and his pedigree is a good illustration of the Talmudic dictum that " Learning will never die out among the descendants of a family in which there were scholars in three successive generations " ; for his direct ascendants, for at least seven generations, were distinguished rabbinical and secular scholars, as were also at least three successive generations of his descendants.

In 1148, at 13 years of age, religious persecution compelled him to leave Cordova, together with others of his family. After being driven from pillar to post in various parts of Spain, he reached Fez, in Morocco, in 1159. During these eleven years of pilgrimage and extraordinary hardships, young Maimonides not only eagerly imbibed the rabbinical and secular instruction of his erudite father, but seized every opportunity to acquire a sound knowledge of philosophy, mathematics, astronomy, medicine, and the natural sciences from the famous Moslem authorities of the day. Finding that the Jews in Fez were—in obedience to orders—rapidly embracing Mohammedanism, Maimonides, who was not suspected of being a Jew, at great peril to his life, secretly circulated a pamphlet against apostasy, beseeching the Jewish community to remain loyal to their faith, in spite of pressure from the ruling authorities. This clandestine campaign which was eminently successful was, in time, detected, and together with his father and other members of his family, he had to flee for his life. In the darkness of night in April 1165, he secretly embarked for Palestine, which he reached a month later, after a stormy and very hazardous passage. Finding, however, the local Christian régime no less intolerant than the Mohammedan from which he fled, and the Jewish community numerically and intellectually too greatly reduced by the Crusades to afford sufficient scope for the exercise of his versatile and fiery genius, he left for Egypt at the end of the same year and permanently settled in Fostat near the modern Cairo.

He was now thirty years of age, and in his new home he continued his studies and busily occupied himself with Jewish spiritual and communal affairs, while his younger brother, David, to whom he was deeply attached, carried on a merchant's business and supplied him with the necessary financial support. Within a short while, however, David lost his life in a shipwreck while on a trading voyage. Maimonides, who not long before had also lost his father, was left heartbroken and penniless. Not wishing to accept money for his spiritual administration—because that would be against the rabbinical ideal that learning must not be used as " a spade wherewith to dig "—he decided to utilize his medical knowledge for a livelihood. His great professional skill and learning, his dynamic energy, his sympathy with human nature, his tact, idealism, enthusiasm, and abhorrence of quackery, his logical and systematic mind, his courage, and great personal charm, soon earned fame for him far beyond the borders of Egypt. In 1174 he was appointed Court physician to Vizir Alfadhel, who was regent of Egypt during Saladin's prolonged absence on his various campaigns—such as against the Crusaders in Palestine, and elsewhere. Richard Cœur-de-Lion, Saladin's opponent in the third crusade, invited Maimonides to become his personal physician—an honour which he declined.

After a while the medical practice of Maimonides became overwhelmingly arduous, and every afternoon on his return from his official visit to the Palace at

Cairo ($1\frac{1}{2}$ miles from Fostat), he found his waiting-room packed with patients of all creeds and classes of society whom—after a hasty meal (the only one he took in twenty-four hours)—he attended until the early hours of the morning. Saturday was the only day of the week on which he could spiritually commune with his fellow Jews and deliver rabbinical discourses.

Medical writings.—In addition to his work as physician and rabbi, as well as spiritual adviser to whom scholars and Jewish leaders in different parts of the world referred their various difficulties, Maimonides was a prolific and most versatile writer. He wrote on rabbinics, logic, philosophy, medicine, mathematics, astronomy, the natural sciences, &c. The work which more than any other has immortalized his name, is his great Trilogy comprising (1) the *Commentary on the Mishnah*, which he began at the age of 23 while on his wanderings in Spain (with no books of reference, other than the vast library of literature stored away in his gigantic and extraordinarily retentive memory) and finished ten years later; (2) The *Code of the Talmud*, an enormous work in fourteen volumes, each of which consists of numerous separate monumental monographs on many subjects—including psychological medicine and mathematical astronomy; and, most famous of all, (3) the *Guide for the Perplexed*, a philosophical and metaphysical work freely interspersed with references to various scientific topics.

The exact number of his medical books cannot be accurately given. Wüstenfeld[1] enumerates seventeen, but it is probable that some of these are spurious. I shall only mention some of those about the authorship of which there is no doubt. They were all, with one exception, written in Arabic, and frequently translated into Latin and the modern languages. The exception is a small "Synopsis of Hygiene," written for his son in Hebrew, and misnamed *Sefer Refuoth* or "Book of Remedies." It consists of fifty short paragraphs on the various aspects of hygiene and preventive medicine, and is the least important of all his works.

His Arabic medical treatises are as follows :—

(*a*) *Aphorisms.*—Though he modestly states that these were based on Galen, they are not merely a translation, but a critical edition of Galen's work with numerous references to Arabic physicians. The work consists of twenty-five chapters dealing with anatomy, physiology, pathology, symptomatology, diagnosis (with special reference to the pulse—its rhythm and force—as well as the urine—its colour and the nature of its deposits), general and special therapeutics (including venesection, purgation, massage, baths, dietetics, and drugs), surgery and the specialities. The twenty-fifth chapter describes, what no previous writer had dared to discuss, numerous inconsistencies and contradictions in the Galenic writings. The work has been translated into various languages.

(*b*) *Regimen Sanitatis*, written for the Sultan Al Malik al Alfdhal, a man of loose habits, suffering from melancholia. It displays Maimonides' great courage in warning his royal master, upon whose goodwill his own very life depended, of the danger of living a life of dissipation. It is a masterpiece of lucid exposition, and deals comprehensively with physical and psychological hygiene and therapeutics.

(*c*) *Book on Poisons*, written at the request of the Kadi al Fadil with the object of coping with snake-bites, a danger very prevalent in Egypt. It is a most comprehensive and scientific treatise, dealing with the prevention and treatment of poisoning by bites of snakes or other animals, as well as of poisoning in general. It is so modern in its principles of treatment that, with few alterations, it might be adapted for use as a modern book on toxicology. For many centuries it was the recognized textbook on the subject. The following is an outline of his treatment of a bite :

(1) Tourniquet above the wound, to stop the poison entering the blood stream.
(2) Enlargement of the wound by incision, to allow free drainage and escape of the

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[1] *Geschichte der arabischen Ärzte and Naturforscher*, Göttingen, 1840, Nr. 198, p. 109.

poison. (3) Suction of the wound by dry cups or other means. (4) Cauterization of the wound to kill any remaining poison. (5) Closure and dressing of the wound —except in the case of dog bites, when the wound must be left open for forty days, on account of the long incubation period of rabies. (6) General treatment— including that of shock, &c.

In the case of poisons taken by the mouth, he prescribed emetics, purgatives and antidotes, giving the proportions of the various ingredients, exact pharmaceutical details for their preparation, as well as the doses for various ages, climates, severity of symptoms, &c. A feature of this, as of his other books, is the stress on preventive treatment. Thus, all localities in which snakes abound should be fumigated with substances which by their odour drive snakes away.

(*d*) *Treatise on Hæmorrhoids.* This masterly production is really quite modern in its outlook. He denounces indiscriminate operation which, he rightly says, does not remove the cause (viz. an error of digestion), and therefore does not prevent recurrence.

(*e*) *Book on Asthma.*

(*f*) *Book on Coitus*, dealing with its physiology, pathology and hygiene.

Characteristic Features of Maimonides' Medical Works.

The characters which distinguish all his medical writings are :—

(1) *Rationalism,* i.e. the diagnosis, prevention and treatment of disease is based on scientific principles and common sense, and has nothing of the guesswork and mysticism characteristic of mediæval medicine. He deprecates all kinds of quackery, amulets and incantations, and only sanctions faith treatment in very grave cases, and then only for the patient's peace of mind.

(2) *Belief in " vis medicatrix naturæ."*

(3) *Belief in prevention rather than cure.*

(4) *Realization of the reciprocity between mind and body.*

(5) *Advocacy of moderation* in diet, exercise, sexual indulgence, &c. " No one," says he, " would overfeed his animals, yet one does not control the amount of one's own food."

Time will not permit me to epitomize his principles of hygiene—either physical or mental—and I will therefore conclude this paper with

An Assessment of the Place of Maimonides in Medical History.

That Maimonides was an experienced, wise and successful physician, is proved by the following facts :—

(1) Notwithstanding his Jewish birth and creed, he occupied the most exalted position of physician to several royal courts.

(2) His most extensive private practice among all creeds and classes, friends as well as foes.

(3) Famous foreign physicians paid special visits to Cairo to meet him.

(4) A foreign potentate was eager to have him as his own physician.

(5) A famous Moslem poet commemorating his medical achievements, ranked him higher than Galen. The following is a translation of this poem by my cousin, Mr. Reginald V. Feldman, M.A. :—

> Contrast Maimuni's [1] with famed Galen's art :
> Health to the body Galen can impart,
> But the wise Hebrew, with a twofold skill,
> Relieves both Mind and Body from all ill ;
> Shows how base Ignorance can hurt the Soul
> While wisdom, counteracting, makes it whole.
> Even the Moon, obedient to his cure
> From periodic taint would be secure ;
> No spots would mar the fullness of her shining
> Nor would her Birth entail her own Declining.

[1] Maimuni is synonymous with Maimonides.

(6) His prolific medical literary output marks him out as probably the most eminent and scholarly physician, not only of his own time but of many preceding and succeeding generations. For his writings, which are characterized by lucidity of exposition, accuracy of clinical observation, earnestness of purpose, logical thinking, a fund of common sense, and conviction of the superiority of preventive over curative treatment, have secured for him a permanent and honoured memory as a skilful physician and inspiring teacher. It is true that he made no epoch-making discoveries, and that he used the medical material provided by Hippocrates and Galen as well as by the famous Arabic physicians, but he used it with discrimination as a foundation on which to base his own observations—as indeed is the case with the great clinicians of the present day. On the whole we may rank him as one of the greatest master-minds in the Medicine of the Middle Ages, whether of the East or of the West.

Section of Dermatology

President—H. MacCormac, C.B.E., M.D.

[*March* 21, 1935]

Lupus Mutilans Facei.—W. J. O'Donovan, M.D.

L. E., a boy, aged 11, was brought to my clinic at the London Hospital on February 27, 1934. Neither he nor the attendant who brought him could give me any history of his case. A public authority had written to me asking my advice as to whether he were to be deemed incurable. I admitted him into hospital, not feeling that a decision so important to the child could be made without a period of observation and experience of his reactions to treatment.

After inquiry and correspondence it appeared that his disease began with tonsillectomy at a children's hospital at the age of 3 years. At this time the question of curvature of the spine was raised, and he was kept on his back on a board for eight weeks. He then acquired nasal diphtheria, and remained in an isolation hospital for a year and nine months as a "carrier." At this time there was some affection at the end of the nose, extending up to the right eye, and he was discharged and sent to the Middlesex Hospital. I am obliged to Dr. MacCormac for the following abstract :—

" He was an in-patient in the Middlesex Hospital from October 21, 1930 until August 10, 1931. He had been in hospital several times before that, and had also attended the out-patient department of the hospital.

" He had an ulcerated area on the upper lip, with considerable deformity, and also deformity of the nose. The condition was thought to be syphilitic granuloma and he was treated with injections of novarsenobillon. This treatment was discontinued because he developed a rash, but further treatment was given in the form of ultra-violet light and X-ray. He made a slight improvement."

The patient was admitted to the Lord Mayor Treloar Cripples' Hospital at Alton, at the end of 1931, and I am obliged to Sir Henry Gauvain for the following important clinical note :—

" The boy was admitted to this hospital at the end of 1931, with widespread lupus of the face and some involvement of the palate. In addition he had quiescent mid-dorsal caries.

" The lupus, I regret to say, resisted all treatment both by light and by sanocrysin, and continued to spread, with increasing involvement of the buccal cavity. The patient was discharged because we could effect no improvement in his condition. His was the most intractable case of lupus I have come across."

The meagreness of the history may be explained by the allegation recorded: "Child abandoned by parents; four brothers and sisters are alive and well; no tuberculosis is known in immediate relations."

When I saw him he was reserved, sullen, nervous, and physically strong. The face was scarred, ulcerated, and hideously deformed from the orbits to below the chin. The lips and chin showed gross thickening and granular ulceration. The nose was ulcerated with a loss of the nasal cartilages. There was scabbed ulceration about both orbits, with œdema of the lids. A throat specialist was unable to examine and report on his condition of the nose and mouth. A skiagram of the dorsal and lumbar spine on November 13, 1934, showed no evidence of extension of caries. His chest was wet from constant dribbling.

The Wassermann reaction was negative on October 5, 1934 but, acting on the tradition of my department that destructive lupus of the muzzle-area indicates a syphilitic taint, the boy was given eight injections of $0 \cdot 45$ grains of novarsenobillon at approximately weekly intervals throughout October and November 1934 without apparent benefit and with no visible skin reaction. During this time the ward-sister

September 27, 1934.

May 2, 1935.

kept him in bed, so that by gravity he might be trained to swallow his saliva and by virtue of admonition and of the encouragement of everybody in the ward, he no longer dribbles. Under general anæsthesia on the following dates, December 8, 1934, December 29, 1934, and March 1, 1935, the lesions were all painted-out thoroughly with liquor hydrargyri nitratis acidus by the method reintroduced by Dr. Adamson. On each occasion the local reaction was purulent and violent. There was no diarrhœa, and after the effects of each treatment had subsided, the improvement in the skin condition was remarkable and was recorded by photographs, so that to-day he may be regarded as a largely cured case of destructive facial lupus. His spirits have improved, he plays with other boys, and only one social problem remains. I understand that official representations have been made to prevent patients such as this using the public vehicles of the London Passenger Transport Board. The creation of a new, small class of untouchable children, conditioned by their affliction, will make the work of dermatologists in central positions unduly difficult and will discourage provincial administrations from seeking medical aid. This is a new and cruel refinement in modern life which I hope will be resisted with success.

Pustular Psoriasis.—H. W. BARBER, M.B.

M. E., a woman, aged 33 ; married ; two children.

History.—Scarlet fever when aged 13, followed shortly afterwards by psoriasis. The eruption persisted and was more or less generalized at the age of 16. Fourteen years ago she was under my care for a widespread psoriasis of the ordinary type, and she attended my out-patient department from time to time, until 1931, when the eruption cleared up. In August 1934 the patch of pustular psoriasis now present on the side of the right foot appeared, and in December, the patch of ordinary psoriasis now present on the right knee. Three years ago she had attacks of quinsy and has had repeated sore throats accompanied by rheumatism. Her tonsils are large and obviously infected.

Discussion.—Dr. H. D. HALDIN-DAVIS said he thought that the patch on the right knee looked like lichenification. It had not the geometrical margin which psoriatic patches usually showed, neither had the surface quite the appearance of psoriasis. He did not doubt that this patient had had psoriasis when she attended the hospital out-patient department. Although the patch on the foot seemed typical of so-called pustular psoriasis, it did not seem to him that the picture proved the connexion between pustular psoriasis and psoriasis of the ordinary type.

Dr. W. J. O'DONOVAN said that no one could question the diagnosis of this case. He himself had formed the same opinion as Dr. Haldin-Davis about the knee lesion ; in its appearance it resembled lichen planus. The material for observation on the foot was small and resembled podopompholyx in the dry and peeling stage. The association of pompholyx with other neuropathic disorders was well established and frequent. This was, he thought, a case in which there were mutations in the clinical appearances, and its cataloguing did not depend on to-day's appearances, but upon the history observed and recorded over a period of time.

Dr. G. B. DOWLING said there were one or two pustules on the sole which were characteristic, and the patch on the knee was like that on the foot ; he thought, in fact, that he could detect a pustule in it. That brought out a point which he thought explained the position. Psoriasis was, on the whole, a uniform eruption. If one found a psoriasis of one type—for example large intertriginous patches—one did not usually see guttate spots elsewhere. In this case one only saw the pustular type. He had a case which he had been watching two years, in which the lesion had begun as a typical pustular psoriasis of the palms, but in which psoriasis of the ordinary kind had developed later. The eruption on the palms had then changed, and had become more characteristic of the common type of psoriasis there. This, he thought, explained the difficulty here. One did not find a mixture of types of psoriasis in the same case.

Dr. A. M. H. GRAY said that whatever the nature of the patch on the knee, it was characteristic of the type of lesion found on the knees and elbows in association with the type of eruption on the foot.

Dr. BARBER (in reply) said that he agreed with Dr. Dowling and Dr. Gray. In these cases of pustular psoriasis of the extremities, psoriasiform patches were frequently present on the knees or elbows, and in these pustules would periodically appear.

Three Cases of Rosaceous Tuberculide.—H. W. BARBER, M.B.

I and II.—These two cases have been shown at a previous meeting and the diagnosis was then discussed.[1] At a later meeting a microscopical section, made from a group of lesions in the second case, was shown. It was generally agreed that this section confirmed the diagnosis.

Both patients had been previously treated for rosacea along the usual lines, without benefit. They have both received injections of solganal B. over a considerable period, and the effects have been very striking. At the moment the patient in the first case is not so well as when I last saw her, and she says that after the injection given at that time a crop of new papules appeared.

III.—Mrs. E. M., aged 37. No family history of tuberculosis obtainable. The eruption began in September 1934, on the cheeks. It consists of reddish-brown, somewhat translucent papules—lupoid in character, both with and without diascopy, These are now present on the chin and cheeks. There is practically no pustulation.

Investigations.—Nothing abnormal found on X-ray examination of the stomach and intestines.

Chest (Dr. Lindsay Locke) : " Median opacity normal. Large right root. Interlobal streak on the right and some old dense deposits below this." Mantoux tests : Both human and bovine tuberculin gave weakly positive late reactions.

A course of solganal injections has been initiated.

Discussion.—Dr. J. T. INGRAM said he found it difficult to accept the theory of a tuberculous origin for these cases of rosacea on any of the grounds which Dr. Barber had brought forward. He regarded the third case as being in a different category from the other two. Sir Ernest Graham-Little in 1926 had shown a similar case,[2] which Sir Ernest called a peculiar tuberculous affection of the skin following electrolysis. There were discrete lupoid nodules scattered over the face. The patient in the present case had had electrolysis on five occasions during the last six months, and most of the eruption had followed that treatment, though there had been one lesion before it was begun. He (the speaker) thought that in Sir Ernest Graham-Little's case there had been some association between the electrolysis and the eruption, but he did not think that the electrolyses alone had produced the lupoid lesions. Those lesions were dependent on underlying infection of the ordinary septic type—i.e. not tuberculous. He would expect to find, in this patient, a chronic infection of the antrum, or the ethmoid cells, or, possibly, in the mouth. During the last three months he had seen the patient whom Sir Ernest Graham-Little had shown, and because of the unilateral distribution of the eruption he suggested the possibility of sinus infection. The sinuses were investigated, and infection was found.

He felt that many of these pustular and other rosaceas were dependent on hidden or latent infection, not in the sense of focal sepsis. There was a definite vascular relationship between the sepsis and the condition of the overlying skin. He did not think one could accept the tuberculoid structure found on histological examination as evidence of tuberculosis. Many chronic irritative lesions of the skin had such a tuberculoid structure ; ordinary rosacea had it. Possibly in some few cases of lupus vulgaris the condition was not tuberculous at all, but was due to ordinary sepsis.

His last point concerned the use of gold in the form of solganal. He did not think response to treatment by gold was evidence of the condition being tuberculous. For twelve months gold had been used in Copenhagen as a routine treatment for rosacea, and, he understood, with reasonably good results. It influenced the vascular basis of rosacea, and was of benefit in other disorders, like lupus erythematosus, which seemed to depend on a vascular disturbance.

Dr. BARBER (in reply) said that the third case had been thoroughly investigated in

1 *Proceedings*, 1934, xxvii, 1362 (Sect. Derm., 64).
2 *Proceedings*, 1926, xx, 102 (Sect. Derm., 32).

hospital. The section from the second case shown at a previous meeting was taken from a group of lupoid nodules on the forehead—away from the rosaceous area.

He agreed that in long-standing ordinary rosacea one might find giant-cells in chronic inflammatory papules, but the microscopical appearances of such lesions were quite different. He also agreed that benefit from the administration of solganal did not prove a tuberculous origin.

POSTSCRIPT (April 16, 1935).— A papular tuberculide of the fingers and backs of the hands has now developed. These appeared after the third injection of solganal [H. W. B.].

Chloasma Virginum Periorale.—H. CORSI, M.D.

The patient is an unmarried woman, aged 20. For two years she had had a pigmentation affecting the upper lip. It varied in intensity and was more noticeable in the summer. The lower border of the pigmentation was abrupt ; beneath it was a clear strip 2 mm. wide before the red of the lip was reached.

Menstrual history normal. Blood-pressure low—95/70.

References.—VON POOR, *Derm. Wchnschr.*, 1926, lxxxii, Nr. 9. NARDELLI, *Giornale Ital. di Derm.*, 1930, lxxi, 1650-60.

Discussion.—Dr. J. E. M. WIGLEY suggested that the pigmentation was due to the application of eau-de-Cologne, in other words " Berlocque dermatitis." The points in favour were : (1) The sharply defined margin of the pigmentation. (2) The increased noticeability in summer. (3) The position just under the nostrils, where the lips would be dabbed with a handkerchief wetted with eau-de-Cologne. The patient stated that she had done this, and had further said that eau-de-Cologne was the only scent that she used.

Dr. CORSI (in reply) said that with regard to the possibility of the condition being one of Berlocque dermatitis, the appearance from which the name Berlocque was derived was absent. There were no pendant-like processes where eau-de-Cologne had run down. On the contrary the lower margin of pigmentation was horizontal and sharp. And if eau-de-Cologne had caused this condition by being dabbed on with a handkerchief, there could not have been the unpigmented strip just above the lip, which was so characteristic of the condition here and in all other cases described.

? Lymphadenoma : Case for Diagnosis.—J. E. M. WIGLEY, M.B.

John P., aged 64.

History.—The condition began about nine months ago when the patient noticed a small brown spot over the lower part of the sternum. He did not feel very well at the time, but had been to a swimming-bath two days previously and thinks he caught cold there. The spot gradually increased in size up to that of a threepenny-bit. Shortly afterwards two further spots appeared a little below the original one, to be followed by others, one on the right groin and another over the lower part of the chest on the right side. The last two have grown to a larger size than the others, and have both broken down, and are now discharging pus. They are definitely tender. The patient has put on 1½ st. in weight since the operation of prostatectomy two years ago and now looks fairly fit. Well nourished. Tongue slightly furred. Nothing abnormal found in tonsils. No history of adenitis. Nothing relevant in family history.

Lesions.—The lesion in the epigastric region is typical of the original outbreak. It is an elliptical nodule, brown in colour, with a reddish tinge towards the centre. There is a certain amount of peripheral scaling. It is fairly firm to the touch, and at one edge is raised above the surface. It is confined to the skin and not in any way attached to the underlying structures.

The lesion on the right groin is also elliptical in shape, and is rather larger than a shilling in size. Towards the periphery it is reddish-brown in colour. In the centre it is raised above the surface, and has a crateriform opening from which dirty

white pus is discharging; the lesion on the right side of the chest is similar but it has dried up.

General examination.—Nothing abnormal found except occasional extra systoles. Wassermann reaction negative.

Investigations.—Blood-count: R.B.C. 4,810,000; Hb. 94%; C.I. 0·9; W.B.C. 8,100. *Differential*: Polys. 68%; eosinos. 1·67%; basos. 0·34%; large hyals. 2%; small and large lymphos. 28%.

Examination of pus.—Organisms: *Staphylococcus aureus*; *Streptococcus hæmolyticus*.

Skiagram of chest : Negative. As the result of 2/3 P.D. of unfiltered X-rays one of the ulcerated lesions has become definitely flatter during the past week, and the discharge of pus has almost ceased.

Discussion.—Dr. I. MUENDE said that he had removed a small piece of tissue from the largest tumour, which was now ulcerated; when he had first seen the patient it was a small smooth button-like tumour. The epidermis was thinned, and the corium was densely infiltrated with cells, which were arranged in a manner suggestive of Hodgkin's disease. There were little nodes of epithelioid cells showing mitotic figures surrounded by small round cells and numerous plasma cells. He was aware that Hodgkin's disease of the skin did not have a typical pathology, and that the histological picture could vary from a simple small round-celled infiltration to the typical picture seen in affected lymph-glands. This patient now had a small lymphatic gland which was enlarging, and, even in the absence of any general glandular enlargement, this should be removed and subjected to a close examination. An article in the *Acta Dermato-Venereologica* (Vol. xv, fasc. 6, December 1934) stressed the point that the histology of Hodgkin's disease of the skin need not be typical and might sometimes be the forerunner of glandular involvement.

Dr. A. M. H. GRAY said that he did not pretend to make a diagnosis in this case. Dr. Wigley had asked him if he had seen anything similar to this in cases of lymphadenoma. It reminded him (Dr. Gray) of a case of lymphadenoma in an advanced stage, seen several years ago, in which necrosis of the skin had set in beginning in the neck. There were no other lesions. The patient was a boy. The condition appeared to be a primary necrosis of the skin.

The other condition of which this case reminded him was that in a case[1] which Dr. H. Semon had shown, with multiple tumours, which were ulcerating in much the same way as was seen here. It was thought to be a case of mycosis fungoides but turned out to be one of primary sarcoma of the skin.

Dr. H. T. BARRON asked whether it was not usual for the cutaneous lesions due to Hodgkin's disease to itch. This man said he had never felt any itching.

Dr. W. FREUDENTHAL said that judging from the sections shown on the slides, he thought the condition was sarcoma.

Melano-carcinoma.—ROBERT KLABER, M.D.

The patient is a woman, aged 24. For as long as she can remember she has had a small growth on the inner aspect of the right thigh. Two years ago she knocked it, causing it to bleed, and the bleeding recurred frequently after minor traumata. She consulted her doctor who proposed excision, but as this was refused, he treated the growth for nine months with repeated applications of a caustic.

When first seen, a year ago, she presented ulceration as a result of the caustic treatment, a mass of confluent pinkish-red smooth nodules in the treated area, and an enlarged inguinal gland. An excised nodule showed an alveolar melano-carcinoma, containing very little pigment.

Mr. E. Gillespie performed a block dissection of the inguinal glands, and finding the deeper glands also affected, went on to include a retroperitoneal excision of all the iliac and lateral pelvic glands and of the aortic glands as far as the renal vessels. A month later, Mr. Lawrence carried out a wide local excision of the affected skin, which included a block dissection of the subcutaneous tissue and underlying fascia.

[1] *Proc. Roy. Soc. Med.*, 1928, xxi, 1427.

Microscopic examination of the glands showed melanotic deposits in all except the higher aortic glands, which were the site of chronic inflammatory changes only.

Two months later, two pin-point black spots appeared just below the termination of the scar. Latterly, these have increased considerably in number, and slightly in size. There is now a large number of these very small brown or black nodules lying in and around the scar, covering the site of the primary lesions.

There are no palpable glands, and the liver and spleen are not palpable. Skiagrams of the lungs show nothing abnormal and the patient's general health remains good.

The important question arises as to whether any further treatment is desirable and if so what form it should take.

Discussion.—Dr. H. CORSI said that a heroic attempt had been made to save this girl's life, and in pursuance of that he (the speaker) thought the leg should be amputated. He said there was the possibility that she might survive, all the lymph-channels having been blocked off all the way up the thigh. A more important reason still for that step was that after amputation her remaining time would be less unpleasant, as these tumours later became very objectionable.

Dr. KLABER (in reply) said he had hoped that other suggestions might have been made ; it was difficult to be sure what would be the best thing to do. He had hesitated to advise amputation, as the patient had already undergone two extensive operations and the ultimate prognosis must in any case be uncertain.

Elephantiasis Nostras Verrucosa.—ROBERT KLABER, M.D.

This woman is aged 42. For the last nine years she has had recurrent attacks of lymphangitis affecting the right leg. Each of these was ushered in by a rigor, followed by diffuse reddening of the leg and the appearance of a lump in the groin. She has never been abroad. She has had five children and gives no history of puerperal sepsis. Mr. A. Goodwin reports that there is no evidence of pelvic infection.

The right leg shows diffuse lymphatic œdema but the foot is apparently free from this. On the lower half of the leg and outer aspect of the dorsum of the foot, are a number of suppurating firm vegetative masses.

The Wassermann reaction is negative. The Mantoux test has not yet been performed. Several weeks' administration of mercury and iodides by mouth has not diminished the exuberance of the lesions, though they are less purulent since the use of hot fomentations.

A section shows a warty overgrowth of the epithelium, with marked lymphangiectasis, œdema, and a mixed-cell infiltrate in the upper part of the corium. In the deeper part, however, are poorly staining areas, rich in giant cells and epithelioid cells, surrounded by small lymphocytes which may be properly described as tuberculoid.

Discussion.—Dr. R. T. BRAIN asked whether the warty growth had appeared since the treatment, as it looked like an iodide granuloma.

Dr. KLABER (in reply) said that the vegetative condition was of many months' duration before treatment was begun. The patient had had no iodides until recently.

Pityriasis Lichenoides et Varioliformis Acuta following (?) Erysipeloid. —ROBERT KLABER, M.D.

This man, aged 27, is manager of a butcher's shop. During Christmas week he pricked the dorsal surface of the base of his thumb with a bone which he thinks was either from pork or rabbit. A swelling appeared and gradually spread over the hand centrifugally, showing a well-defined margin. It subsided after a period of about a month. At this time an irritable follicular eruption appeared on the flexor surfaces of the forearms and gradually spread upwards. There is now an extensive slightly scaly bright-red macular eruption affecting particularly the flexor surfaces of the forearms, the sides of the trunk, the lower part of the abdomen, the front of the upper third of the thighs and the sacrum. This is fading above, but extending

on the legs. He states that there have been some water-blisters amongst the lesions and there is an occasional small depressed scar to confirm this. The parts of the groins covered by a truss seem to enjoy some degree of immunity from the eruption. Most of the lesions show a definite purpuric element, persistent under glass-pressure. There is no seborrhœa or adenitis. The Wassermann reaction is negative.

Discussion.—Dr. A. M. H. GRAY said he did not think that this was pityriasis lichenoides et varioliformis acuta, or chronica either. He did not observe any scars. The distribution was unusual, the trunk being much less affected than the limbs in this case ; the reverse was the usual order in pityriasis lichenoides. The individual lesions also seemed to differ; there were none of the smooth, well-defined pinkish papules nor the mica-like scales which had been described. The lesions, in fact, were more like those of psoriasis-en-plaque. The general picture was rather like that of the type to which Pernet had given the name xantho-erythrodermia perstans. The lesions had, however, been present only a short time and appeared to be clearing so that it was premature to make a diagnosis of parapsoriasis.

Dr. KLABER (in reply) said he agreed that one could hardly expect anyone to accept the suggested diagnosis in the present state of the case. The lesions had already faded consider-ably on the arms and trunk. He attached the suffix "acuta" because the condition began acutely and there was the history of blisters which had left scars though these were admittedly small, and few in number. The further course of the case must be awaited to complete the diagnosis.

Postscript (18.6.35).—The eruption had entirely disappeared four weeks later.—[R. K.].

Lichen Planus following treated Syphilis.—ROBERT KLABER, M.D.

This woman is aged 24. She attended St. Bartholomew's Hospital in 1933 with a secondary papular syphilide on the palms. The Wassermann reaction was then strongly positive ($++$). She attended the Special Treatment Centre at the Hospital for three months and then continued to be treated at another Centre for twelve months. The last injection of organic arsenic was given in May and the last bismuth injection in October 1934. The Wassermann reaction was then negative.

In December 1934 a typical eruption of lichen planus appeared on the back, with atrophic annular lesions round the anus. The Wassermann reaction was then again negative, and is now still negative, as is also the sigma reaction.

Several cases of lichen planus occurring during the course of treatment for syphilis have been reported during the last few years and have given rise to speculation as to their relationship to the primary disease and its treatment.

If further cases are observed, such as this one, following the treatment of syphilis, and with negative serology it might not be unreasonable to suggest that the administration of arsenic and/or bismuth has sensitized the tissues to the virus of lichen planus, whatever this may prove to be.

Two Cases of Melanoderma following Heavy-Metal Administration.—HUGH GORDON, M.R.C.P.

(I) Male, aged 63.

History.—Came under treatment in September 1933, for syphilitic aortitis. Given four injections of stabilarsan, totalling $1 \cdot 65$ grm., together with four injections bisoxyl, each of 2 c.c. Immediately after the fourth injection he developed an exfoliative dermatitis. He was admitted to hospital where he remained for ten months. During the course of the dermatitis, which was extremely pruriginous, there appeared over the body pigmented patches which have remained unaltered ever since. On January 1, 1935, he was given one further injection of bisoxyl, 3 c.c., which was immediately followed by a second, but milder, attack of exfoliative dermatitis lasting three weeks.

Present state.—Scattered irregularly over the trunk are small areas of deep brown pigmentation on a background of normal skin. On the arms and neck the pigmentation is of a reticulate nature, and much more extensive. The intervening

islands show some degree of depigmentation. It is important to note that the arms and neck have been the site of a slight leucoderma for many years.

(II) Female, aged 55.

History.—This patient had psoriasis for many years, together with arthritis for the last three years. She was treated for the psoriasis, between October 1933 and March 1934, with 38 c.c. of mercolloid, without improvement. Between April and July 1934, she received nine injections of sanocrysin, each of 0·05 grm. (i.e. 0·45 grm. in all. The arthritis decreased considerably, but not the psoriasis.

After the last injection, patches of dermatitis appeared on the face and flexures. These spread slowly for the next three months and were extremely irritating. In addition the psoriasis became worse. When first seen on November 15, 1934, there was a widespread psoriasis of the guttate type, together with large areas of dermatitis, which more or less covered the trunk, neck, and face. In the flexures and on points of pressure were pigmented patches of a deep brown colour, varying from one inch to three inches in diameter.

She was admitted to hospital for three months, by the end of which time the psoriasis and exfoliative dermatitis had cleared up, but the pigmented patches remained unaltered.

Present state.—There are a few patches of psoriasis scattered over the body. The skin, generally, is rather rough and dry. Round the neck, and on the shoulders, waist, and groins are pigmented, lozenge-shaped areas, deep brown in colour and slightly hyperkeratotic.

Report on a microscopic section from the forearm (Dr. R. Klaber).—" Epithelium : The horny layer is thickened, consisting of several layers of non-nucleated, but imperfectly keratinized, cells. The granular layer is well marked. The prickle-celled layer shows spongiosis, with acanthosis and downgrowth of rete-pegs.

Corium : Shows in its upper two-thirds much new capillary formation, surrounded by a dense infiltrate consisting chiefly of histiocytes, showing early degenerative changes. Chromatophores are also present in large numbers."

The history of both these patients is very similar. They both present abnormal pigmentation following a dermatitis of exfoliative type produced by heavy metal administration. The amount of the metal usually incriminated in such cases, which was given, was conspicuously small, i.e. 1·65 grm. of stabilarsan and 0·45 grm. of sanocrysin. In both cases, however, a second heavy metal was also given, which, in the case of the man, by itself produced a second attack of exfoliative dermatitis.

This type of melanoderma, subsequent to an exfoliative dermatitis, does not correspond to the usual arsenical pigmentation occurring after oral administration of the drug, nor to the diffuse bluish staining, most marked on light-exposed areas, which has been reported during gold-salt therapy, and named by the French " chrysocyanose."

It is, however, not uncommon. The question of interest is whether the drug is responsible for the melanoderma or whether all that the heavy metal does is to produce an exfoliative dermatitis. When this happens to occur in patients with disturbed pigmentary balance, it may be followed by hyperpigmentations of this nature.

The PRESIDENT said he thought that the patient in the second of these two cases had lichen planus ; she had patches in her mouth. The section shown, however, did not look like lichen planus.

Granuloma of the Hand.—HUGH GORDON, M.R.C.P.

Male, aged 64.

History.—Patient noticed a boil on the back of his right hand about two years ago. This spread, and has covered nearly the whole of the back of the hand. It has advanced with a granulomatous, ulcerative edge, leaving a honeycombed, rather violet-coloured scar behind it.

He works with horses and the appearance suggested at once a case of primary

actinomycosis of the hand shown by Dr. Klaber some months ago.[1] Investigation has as yet, however, proved negative.

Wassermann and Mantoux reactions negative. Biopsy showed simple granulation tissue.

Dr. Klaber examined the patient for *Bacillus actinomycetem comitans*, but failed to find it. A Gram-negative coccobacillus in pure culture was however isolated ; as yet it is of an unknown nature.

The condition has very much improved during the last month under treatment by a mercury and boracic ointment, and applications of carbon dioxide snow to the edge, as was suggested by Dr. Goldsmith in a rather similar case.

Discussion.—Dr. KLABER said that as there were some resemblances between this case and one from which he had obtained a pure culture of *B. actinomycetem comitans*, he had adopted the same technique in this case.

He had thoroughly cleansed the growing edge and after scarifying it had swabbed directly on to a blood-agar plate. A culture was obtained which was obviously not *B. actinomycetem comitans* ; it was thought, on clinical grounds, that it might prove to be a staphylococcus.

Stained films, however, showed that it was a Gram-negative coccobacillus. Dr. Garrod had undertaken its further investigation, which was not yet complete. He (the speaker) was able to state, however, that it had not the characters of *B. coli*, or of the glanders bacillus. It did not ferment any of the sugars, and would not grow in peptone water.

Dr. A. M. H. GRAY asked whether tuberculosis had been excluded, as that seemed to be the first clinical diagnosis to consider.

Dr. SIBYL HORNER said the case reminded her of one in which there had been a similar type of lesion. The patient was a man employed in a chair manufactory, and his work was associated with damp straw, with which the chairs were packed for delivery. She believed that in that case the lesion had been diagnosed as due to infection from a streptothrix (a group to which ray fungus belonged) which was cultivated from the straw used. In the case shown the patient was associated with horses and, therefore, with straw.

The PRESIDENT said he thought there were two clinically distinct conditions included under what might be called pyogenic granuloma of the skin. One was a localized warty or fleshy frambœsiform lesion which had been called botriomycosis, on the false assumption that it was similar to the infective tumours observed after castration in horses. This condition was also termed "proud flesh." The other was represented by a spreading lesion with a raised, warty edge, the centre of which tended to flatten and sometimes underwent atrophy, in this way closely mimicking one form of cutaneous tuberculosis.

Dr. MUENDE said that the histology of verrucose tuberculosis of the skin was not always typical, and one must expect to see anything from simple small round-celled infiltration to the formation of typical tubercle nodules, beneath a warty epidermis. Before one could say that the condition was not tuberculous, several sections should be taken from different parts of the lesion.

Dr. GORDON (in reply) agreed that tuberculosis had not yet been thoroughly excluded ; he would have additional and deeper sections taken. The edge of this granuloma had, however, never been warty at any time. When first seen, a month ago, it consisted of frankly purulent exuberant granulation tissue. It had now much improved.

Cicatricial Alopecia of the Scalp with Keratosis Pilaris.—LOUIS FORMAN, M.D.

Miss I. F., aged 20. There is a three-year history. The hair of the scalp is dry and wiry. There are numerous irregular bald patches over the whole of the scalp, particularly over the vertex. On the bald areas the hairs are short and crinkled, and some show spiral forms. The hair is everywhere easily detached, some of the hairs requiring the minimum of traction. The hair-bulbs are atrophied. The scalp is generally a little atrophic, but there is no follicular keratosis of the scalp hairs. There is well-marked keratosis pilaris of the sides of the face and the extensor aspects of the arms.

The patient has one brother and one sister, neither of whom show any scalp changes.

[1] *Proceedings*, 1933, xxvi, 750 (Sect. Derm. 36).

Clinical Section

President—E. G. SLESINGER, O.B.E., M.S.

[*April* 12, 1935]

Suprasellar Adamantinoma with Signs of Pituitary Insufficiency.— F. S. LANGMEAD, M.D., and A. DICKSON WRIGHT, M.S.

C. W., a boy, aged 13, at the beginning of July 1934, found that he was unable to read, and at school could not see what was written on the blackboard. He often vomited. In December 1934, he began to experience headaches both by day and at night. Because of his defective sight, he was sent to an Eye Clinic by the school authorities in November and attended there daily until Christmas.

On January 4, 1935, he was referred to an ophthalmic surgeon, who, discovering papilloedema, sent him to the out-patient department at St. Mary's Hospital, from which he was admitted to the ward. According to his mother's statement, he had ceased to grow for two years and had been getting fatter.

Nothing relevant in the earlier history. Had mastoiditis when 1 year and 9 months old; two weeks before the onset of the present illness a chronically inflamed appendix had been removed on account of recurrent attacks of abdominal pain and vomiting.

Condition on admission.—A pale, short, obese boy; height 4 ft. 4 in.; weight 4 st. 8 lb. The distribution of body fat was greatest in the abdomen and pectoral and pelvic girdle regions. Afebrile, but complained of headache, and was drowsy, lying mostly curled up on his left side and not easily roused. Pulse and respiratory rate normal. No signs of meningitis. Seemed somewhat dull mentally; slow in responding, but appreciative of what was said to him. His mother said that he "took hours over small errands."

Eyesight very defective; field of vision diminished. Obvious bitemporal hemianopia. Papilloedema pronounced in both discs; no fundal haemorrhages. Hippus was present. No other definite abnormal signs in the central nervous system, and nothing noteworthy found on examination of other systems. Blood-pressure 90/48. No polyuria.

Cerebrospinal fluid: Pressure 300 mm. Hg; 66·6 mgm. of sugar, and 5·7 mgm. of calcium, per 100 c.c. 20 cells per cm., consisting of lymphocytes and monocytes. No pus cells and no organisms. Wassermann reaction negative. Colloidal gold test negative; globulin and total protein not increased.

The headache and vomiting diminished after lumbar puncture.

The combination of signs of intracranial pressure with bilateral temporal hemianopia, stunting of growth, obesity, and mental sluggishness with drowsiness appeared to make the diagnosis of pituitary tumour plain, and this was borne out by X-ray examination.

Radiological report.—Pathological enlargement of sella, with erosion of sphenoid anterior to this, and of lesser wings of sphenoid. Mottled area due to deposits of calcium, above and to the right and slightly anterior to the front of the sella. This does not indicate definitely that there is a greater tumour mass on the right than on the left, since there may be as much on the left, but no calcification to render it

visible. The skull shows evidence of a considerable degree of internal hydro-cephalus, (?) due to pressure on the third ventricle, although the posterior clinoid processes are well seen, being thinned out, but distinct.

The diagnosis in this boy's case was quite definite, the skiagram show-ing the characteristic beaded calcification of suprasellar adamantinoma. It was also certain that the cyst was a very large one, and by pressing on the third ventricle, had produced a high degree of internal hydrocephalus; the spreading of the sutures, the papilloedema, and the high intrathecal pressure confirmed this. The pressure of the cyst upon the pituitary gland had been of such a degree as to interfere with its secretions, with the result that the growth had come to a standstill and the boy was possibly showing signs of Frölich's syndrome. The pressure of the cyst upon the optic nerves had produced a complete bitemporal hemianopia, and the drowsy semi-comatose condition of the boy indicated the high degree of intracranial pressure present.

January 18, 1935 : *Operation* (A. Dickson Wright).

A flap, of the type described by Frazier, was turned down, and a bone-flap, hinged upon the temporal muscle, was turned back. The anterior horn was then tapped and had a pressure of no less than 30 in. of water. The ventricle was emptied and the dura opened. The frontal lobe was elevated with some difficulty, because of the increased pressure, which was quickly reduced when the cyst was reached and evacuated of 50 c.c. of greenish-yellow fluid full of cholesterin crystals. The cyst was then dissected away and it was found to have three main compartments, each of which were emptied in turn. The wall of the cyst contained much more calcification than the skiagram had indicated, and the portion of the tumour between the optic nerves was solid. The cyst was most extensive in its distribution, reaching forward to the commencement of the falx and extending out to the temporal bones on each side, and at the conclusion of the operation the temporal bone on the opposite side could be seen. The space left was filled with saline and the flaps were sewn back carefully without drainage. The time of the operation was four hours and a blood-transfusion of 280 c.c. was given at the end of the operation.

The recovery was very smooth; the much dreaded hyperpyrexia did not develop, great pains being taken to keep the patient cool.

Since the operation, the patient has lost the bitemporal hemianopia, the papilloedema has gone, and he is bright and wideawake with vision $\frac{6}{12}$ in the left eye, and $\frac{6}{36}$ in the right.

Pathologist's report (Dr. W. D. Newcomb).—Adamantinoma of pituitary. The structure is quite typical. Parts are cysts lined by columnar epithelium; in other parts the epithelium is in large masses with small cysts, and in others it is squamous, with definite cell-nests which are frequently calcified. Only a small amount of fibrous tissue is present.

Dr. W. M. FELDMAN said that he thought that the patient still had bitemporal hemianopia—as measured by the finger test. He agreed that there were now no changes observable at the discs.

Simmonds's Disease (Pituitary Cachexia).—MAURICE SHAW, M.D.

Laurence B., born October 12, 1916; only child of healthy parents. Admitted to hospital on account of extreme wasting, especially during the last two months.

Normal baby, and apparently normal during his first six years. Has always been subject to bilious attacks with vomiting (? migraine) and has had measles, whooping-cough and scarlet fever.

Left school at age of 14 ; schooling much interrupted by ill-health. Abnormally thin at age of 14 but did not begin to lose weight materially until two years ago, when he weighed 6 st. During two months previous to admission (i.e. during November and December 1934) lost weight more rapidly and, on admission,

weighed 4 st. 1 lb. Not complaining of any symptoms beyond constipation and loss of appetite.

Condition on examination.—Extremely emaciated; practically complete absence of subcutaneous fat and poor muscular development. Upper jaw prominent; receding chin, but this was noticeable in a photograph taken at the age of $4\frac{1}{2}$. Distribution and quantity of hair perfectly normal; skin, a little wrinkled, but healthy; no appearance of progeria. Testicles small but no other glandular abnormality discovered. Teeth very carious; defective enamel-formation, especially in incisors. Chest expansion poor; abdomen scaphoid. No physical signs detected in internal organs or in central nervous system. Visual fields and fundi normal.

Investigations.—X-ray examination: Chest, normal; barium meal, normal (no evidence of microsplanchnia); skull (stereo) normal. Stools and urine: Chemically and bacteriologically normal. Blood-sugar: Fasting 98 mgm. %; tolerance curve: fasting 80. Half-hourly samples showed 80, 100, 80 and 90 mgm. %. Blood-urea: 37 mgm. %.

Blood-count: R.B.C. 4,360,000; Hb. 84%; W.B.C. 20,000; C.I. 0·97. Poly. neutros. 65%; eosinos. and basos. 0 in 250 cells; monos. 20%; lymphos. 15% (mainly large). Platelets normal; no shift to left; no leukæmic cells.

Wassermann and Kahn reactions negative. Basal metabolic rate: 13.2.35, −29%; 25.2.35, −28%.

Progress and treatment.—Difficult to feed. Takes very little and is slow in eating. Temperature chart shows some degree of hypothermia; pulse varies from 60 to 100. Mental condition fairly normal; no evidence of disorientation but has a passion for collecting papers, periodicals, and books, which he never reads. Seems morbidly interested in the time; complained that he could not see the ward clock; sits looking at his watch while feeding, and even takes it to the bathroom. Is inclined to hoard odd bits of food in his locker but does not eat them.

On February 1 was given an acid strychnine mixture before meals and haliverol ℔ 3, t.d.s. On February 20 (weight 4 st. $1\frac{1}{2}$ lb.) he was given whole gland pituitary, gr. $\frac{1}{8}$ t.d.s. and a bottle of Guinness's stout daily. On February 26 the pituitary was increased to gr. 1 and then, at intervals of four days, to gr. 3, gr. 5 and gr. 8. This was continued until March 22 when his weight was 4 st. $4\frac{1}{2}$ lb. On March 23 100 units of pregnyl (1 c.c.) were given intramuscularly and this has been continued up to the present date. The weight increased more rapidly after the pregnyl treatment was started and the temperature has increased. The appetite has also slightly improved.

The only other treatment has been insulin-and-glucose (in January) which did not seem to have much effect on the weight, and recently he has been taking malt and cod-liver oil.

Discussion.—Professor F. S. LANGMEAD said that he would like to emphasize two aspects of Simmonds's disease: (1) The anorexia accompanying it, and (2) its polyglandular nature. Anorexia was sometimes the most troublesome symptom, and the distaste for food so great that, in addition to the extreme wasting, there was considerable risk of avitaminosis. In one such case under his own care, the patient, a boy aged 17, had developed xerophthalmia. Anorexia nervosa had been provisionally diagnosed in three cases of which he had knowledge, but in which the later diagnosis of Simmonds's disease was undoubted. The obstinate refusal to take food and its surreptitious disposal were, perhaps, not sufficiently recognized as part of the clinical symptoms.

With regard to the polyglandular nature of the disease: Although the initiating factor might be concerned with the pituitary gland, post-mortem examination might reveal as great or even greater deviation from the normal in other ductless glands. He might quote a case (in a boy aged 19) in which the anterior lobe of the pituitary gland was small, showing few acidophil cells and relatively more basophils, but in which several other ductless glands were also affected. The pancreas contained very few cell islets; the interstitial cells of the testicles were greatly reduced and showed no spermatogenesis; the parathyroids were atrophic;

the thyroid was infantile in type; the adrenals contained very little lipoid, and their cortices were very small; the thymus contained fœtal fat. The marrow was also hypoplastic. The patient was dwarfed, and emaciated to an extreme degree.

He also recalled a case (in a young woman) in which amenorrhœa was associated with a small sella turcica. Other associations were serious wasting, anorexia, achylia gastrica, and a low blood-pressure (the systolic being 95 mm. Hg, the diastolic indeterminable by the instrument available), a basal metabolic rate of − 21, and slight hirsuties on the face. Eucortone had had the effect of raising the blood-pressure, restoring the appetite, and leading to an increase of weight—from 4 st. 3 lb. to 4 st. 10 lb. 8 oz. in two months.

Dr. S. LEVY SIMPSON said that Dr. Shaw's case was one of great interest, and although it had many features in keeping with Simmonds's cachexia, the presence of normal pubic, axillary, and facial hair, together with a normal penis, would make one hesitate in making the diagnosis. If, as indicated by the photographs shown and by the clinical history, the disease had begun at the time of puberty, it was difficult to harmonize a gross anterior pituitary deficiency with apparently normal development of primary and secondary sexual characteristics. Early direct results of experimental hypophysectomy were cessation of œstrus, impotence, and atrophy of the genitals.

Although spontaneous improvement occasionally occurred, the treatment of Simmonds's cachexia, in his experience (necessarily somewhat limited) was not encouraging. Since atrophy of the adrenal cortex resulted from experimental hypophysectomy and was a feature in Simmonds's disease, it was natural to think of the therapeutic possibilities of cortical extract. This view was supported by the finding of Atwell that cortin restored hypophysectomized animals to apparent normality, but subsequent careful experiments by Shumacker and Firor had failed to confirm this work in any degree, their results being completely negative. He (the speaker) had not found cortical extract of real benefit in Simmonds's cachexia (or in a surgically hypophysectomized patient) and this comparative lack of response as compared with that obtained in primary adrenal deficiency (Addison's disease) was of value in differentiating the two conditions when diagnosis was uncertain.

Good therapeutic results had been claimed for the gonadotropic hormone of pregnancy urine, but Evans and co-workers had found that it was of no value in hypophysectomized animals. Adrenotropic hormone, however, tended to return these animals to apparent normality. Prolan, pregnyl and other similar gonadotropic preparations did not contain the adrenotropic factor. It seemed, on physiological grounds, that the use of adrenotropic and thyrotropic hormones should supplement gonadotropic hormone if appreciable benefit were to result in Simmonds's cachexia. Unfortunately such therapy might be impeded by the production in the patient's blood of anti-thyrotropic and anti-adrenotropic hormones. In considering the more optimistic claims of clinical cures the question of differential diagnosis could not be ignored.

Dr. PARKES WEBER said that in typical cases of anorexia nervosa (in young females) there was often a marked tendency to restlessness—the patients seeming always to be busy—whereas mental torpidity and a general sluggishness constituted a striking feature in the present patient.

A Family of Nephritics.—COURTENAY EVANS, M.D.

E. P., aged 41, came for examination at St. Bartholomew's Hospital, as there had been so much nephritis in the family. The patient stated that she felt quite well.

Condition on examination.—Dark Jewish woman. Heart a little enlarged; aortic second sound booming; arteries thickened (radial and brachial); blood-pressure: arms 240/130, legs 300/150; pulse 72 per minute, regular rhythm. The right kidney was palpable. Urine turbid; specific gravity 1008; albumin 0·05%. no sugar present; centrifuged deposit showed a moderate number of red-blood cells, a few epithelial and hyaline casts, culture *B. coli* (catheter specimen). Urine is being examined for lead.

Urea clearance test: 69% first hour, 65% second hour. Blood-urea 24 mgm. per 100 c.c.

Blood-count: R.B.C. 4,900,000; Hb. 90%; W.B.C. 9,200. *Differential:* Polys. 54%; lymphos. 40%; large monos. 3%; eosinos. 1%; basos. 1%; myelocytes 1%. Sedimentation rate 6 mm. (one hour). Wassermann reaction negative.

Skiagram of heart: Left ventricle enlarged and rounded, aorta a little wide and rather short. Skiagrams of kidneys (uroselectan) normal.

Report on retinæ and retinal arteries.—No abnormality seen (Mr. Rupert Scott).

R. P., aged 26, came to hospital complaining of rheumatism of the shoulders. *Condition on examination.*—Rather hirsute woman, particularly on abdomen. Heart and lungs normal; arteries soft. Blood-pressure 150/74. Urine: specific gravity 1022; albumin 0·1% (Aufrecht). Centrifuged deposit showed occasional hyaline casts and no red cells. Urea clearance test: 91% first hour, 84% second hour. Blood-urea 30 mgm. per 100 c.c.

Blood-count: R.B.C. 5,040,000; Hb. 100%; W.B.C. 7,600. Polys. 80%; lymphos. 12%; large monos. 4%; eosinos. 2%; basos. 1%; myelocytes 1%. Sedimentation rate 8·5 mm. (one hour). Skiagram of kidneys (uroselectan) normal. Skiagram of pituitary fossa normal. Diagnosis as to the presence of active nephritis is in doubt.

I am indebted to Dr. Geoffrey Evans for permission to show this case.

A FAMILY OF NEPHRITICS.
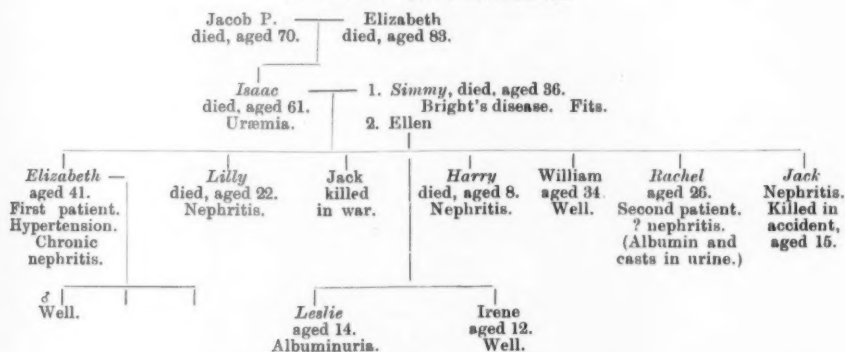
Family history.—In three generations probably seven members have suffered from nephritis, three of these having died of the disease.

Isaac P., father, died, aged 61, in St. Bartholomew's Hospital of uræmia. Blood-pressure 208/135. Retinal arteriosclerosis. Urine contained albumin, red cells and granular casts. Blood-urea 62 mgm. per 100 c.c., six weeks before death.

Simmy P., mother, died, aged 36, of Bright's disease, in fits.

Elizabeth, aged 41, first patient, definite chronic nephritis.

Lilly, died, aged 22, in the London Hospital. *Symptoms:* headache; amblyopia; dyspnœa on exertion. Heart enlarged, retinal arteriosclerosis with retinitis. Blood-pressure 160/?. Urine contained albumin. *Diagnosis,* by Dr. Wall (one year before death); chronic nephritis, Rose-Bradford type. (No post-mortem examination.)

Jack, killed in the war.

Harry, aged 8, died in the London Hospital. *Diagnosis:* chronic parenchymatous nephritis. Albumin + +. Scarlet fever and nephritis six years earlier. *Post-mortem report.*—Kidneys slightly contracted, waxy, white, granular subcapsular surface, cortex diminished.

William, aged 34. Urine normal, no evidence of nephritis.

Rachel, aged 26 (second patient).

Jack, in London Hospital at age of 7½ with nephritis. Albumin; granular casts and red cells in the urine. Blood-pressure 130/? (patient was killed in an accident).

Isaac P. had two children by his second wife one of whom a boy, aged 14, has albuminuria but no red cells or casts in the urine.   Blood-pressure normal.

Discussion.—Dr. W. M. FELDMAN said the pedigree-tree suggested that the nephritis in this case behaved as a Mendelian dominant character.   The first marriage, presumably DR × DR, resulted in several children with nephritis (theoretically the number of nephritics : the number of normal children should be 3 : 1, due account being taken of the "probable error ").   The second marriage, DR × RR should theoretically produce equal numbers of nephritic and normal children, when large numbers were considered.   The probable error, however, might quite easily reduce the number of nephritic children (in the small number in this particular mating) to zero, as was the case here.

Dr. PARKES WEBER said he thought that in such "nephritic families " one would expect to find an occasional example of "renal rickets " or "renal infantilism," but he had not heard of any case supporting this expectation.

Hepatomegalia Glycogenica (von Gierke's Disease) associated with Infantilism, in Three Siblings.—R. W. B. ELLIS, M.D. (by permission of F. J. POYNTON, M.D.).

The three patients are the only children of healthy parents, who are unrelated. No similar condition is known in either parent's family.   The Wassermann reaction of both parents is negative.
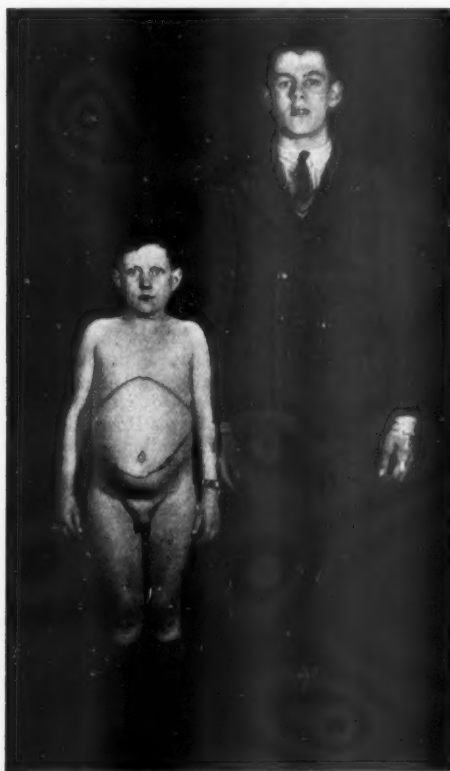
Albert B., aged 17, with normal control.

(1) Albert, aged 18 years. Admitted to hospital in 1920 on account of large abdomen, which had been noted since earliest infancy. He was a full-term baby, weighing 9 lb.; normal delivery. No symptoms during infancy except occasional vomiting and, later, epistaxes. At age of 3 years appeared to be well developed, weighing 33½ lb.; the abdomen was greatly distended by the enlarged liver, which reached to the umbilicus. No other physical signs of disease were found. He was readmitted six months later, on account of jaundice and vomiting of sudden onset, associated with a single severe epistaxis and bile in the urine. The jaundice cleared rapidly. Since this time he has been in good general health, and has earned his living as an office-boy for the past four years. Since early

Control,
aged 10 years and
3 months.

Olive,
aged 13 years and
5 months.

Alma,
aged 10 years and
7 months.

childhood there has been an increasingly obvious degree of statural infantilism. At the age of 14½ he was the height of a normal boy of 8.

Present state.—Height 49 in. (124 cm.), weight 67 lb. (approximately that of a normal boy of 10½); the boy appears well, but has a somewhat muddy complexion, though he is not jaundiced. He has the brevilinear proportions, small maxilla, and small nose of early childhood, and is completely infantile as regards genital development and secondary sexual characters. The abdomen is very prominent, and the smooth, firm, non-tender liver extends 22 cm. below the xiphisternum in the midline. Spleen not palpable.

(2) Olive, aged 14 years, has been quite well apart from retardation of growth and transient jaundice following tonsillitis at 18 months of age. She is good at games, and normal for age in school-work. At the age of 3½ years she measured 30½ in. (normal 36 in.). The abdomen has been large since birth. She has not menstruated. There have been no hypoglycæmic symptoms.

Present state.—Height 47 in. (normal for age 60 in.). Abdomen prominent, with firm, smooth liver extending to umbilicus. Spleen not palpable. Dentition considerably delayed, but appearance of centres of ossification within normal limits. Sella turcica normal. There are several small telangiectases on the face, and she has a muddy complexion similar to that of her brother whom she closely resembles. No secondary sexual characters have appeared.

(3) Alma, aged 11 years, has also been free from symptoms. She appears in every way more normal than Albert and Olive, and her retardation in growth is less marked. She is particularly good at games.

Present state.—Height 46½ in. (normal for age 54 in.); dentition delayed; ossific centres and sella turcica normal for age. Liver extends three fingerbreadths below costal margin. No secondary sexual characters or menstruation.

Biochemical investigations (Dr. Payne).—The essential findings are the presence of acetone in the urine under conditions of everyday life, and a low fasting blood-sugar. The two younger children show a delayed rise in blood-sugar following the injection of adrenaline. (It has not been possible to carry out this investigation on the boy.) The abnormalities are least marked in the youngest child.

Blood-cholesterol: Olive, 346 mgm.%; Alma, 208 mgm.%.

Painful Recurrent Carcinoma Mammæ treated by Selenium and X-rays with Immediate Relief from First Injection (*From the Croydon General Hospital Clinic for the After-care of Breast Cases*).—F. HERNAMAN-JOHNSON, M.D.

Mrs. E. M., aged 44, had a minor operation on the right breast in February 1928. Removal of breast September 1933. Treated by X-rays and light, November 1933 to May 1934. Blood-serum examined by vanadic acid test, September 1934, and found very satisfactory.

Patient then had illness in her family, and was greatly overstrained till January 16, 1935, when another test was made. This showed an abnormal graph, and was considered as a warning against secondaries. None could be found at the time, although, of course, the beginnings may have been missed. Soon afterwards the patient had some pain in the breast area, and a definite subcutaneous nodule was discovered on February 20.

The patient was put on to Todd's treatment. The first injection of 2 c.c. sulphur selenium colloid gave complete relief from pain, and this has not returned.

The case is shown chiefly for the purpose of demonstrating the rapidity with which selenium sometimes relieves pain in malignant disease, quite apart from X-ray treatment. Similar relief has been obtained in other cases.

? Subcutaneous Tuberculomata.—A. L. WINGFIELD, M.D. (for DOUGLAS FIRTH, M.D.).

W. D., aged 18, has complained of "lumps in the skin" for two months and there has been some loss of weight. In February 1935, painless subcutaneous nodules appeared just below the xiphisternum. Similar nodules appeared in the following fortnight in various situations. In December 1934, he had had a severe cold and a similar crop of nodules had appeared; these were confined to the legs and disappeared in two or three weeks. He has not been abroad.

Condition on examination.—Temperature 99-101° F.   Pulse, 100-120.

Skin : The nodules are distributed over the limbs, trunk and face, and are about fifteen in number.   They vary from 0·5 to 3 cm. in diameter and have a regularly rounded shape. ' In some cases they appear to be fixed to, or arising from, muscle. They gradually increase in size and some of them are fluctuant.   In a few instances ulceration has occurred and a grumous material has been discharged.   One fluctuant nodule was punctured, and the fluid aspirated contained amorphous débris and a few very degenerate polymorphonuclear cells.   No organisms were seen and culture was sterile.   A guinea-pig has been injected with negative result.

Mantoux test : 1 : 10,000, reaction positive ; 1 : 100,000, reaction doubtfully positive.   Electrocardiogram : normal.   Skiagrams of chest and of bones of skull, arms and legs, show no abnormality.

Blood-count (15.3.35) : R.B.C. 5,400,000 ; Hb. 102% ; C.I. 0·94 ; W.B.C. 9,000. Normal differential count.   A second count gave an almost identical picture.

Report on biopsy.—" Section shows vascular granulation tissue which is diffusely infiltrated with lymphocytes and, more patchily, with polymorphonuclear cells.   In some areas there is actual abscess-formation.   This appears to be due to a chronic pyogenic infection."

Bronchiectasis : Thoracoplasty with Unsatisfactory Result.   Successful Lobectomy.—J. G. SCADDING, M.D. (for J. E. H. ROBERTS, F.R.C.S.).

Mrs. E. G., aged 39, was first treated at the Brompton Hospital in August 1930.

History.—Whooping-cough as a child ; left-sided pneumonia at the age of 21. Since the attack of pneumonia she had had a cough, which had gradually become worse.   At the time of her first admission she had one ounce of sputum a day and had had several small hæmoptyses.

A skiagram taken after lipiodol injection showed left basal bronchiectasis.   Left phrenic evulsion was performed.   This produced no change in the amount of sputum or in the general condition, and in October 1930 she was readmitted.   Left thoracoplasty was performed in two stages, 44 in. of ribs four to ten being resected on October 25 and 13½ in. of ribs one to three on November 8.   There was moderate reaction only after the operations and the patient was sent to Frimley for convalescence in January 1931.   She still had two ounces of sputum daily.

She was observed in the out-patient department at intervals afterwards ; thoracoplasty appeared to have produced very little change in her condition ; the sputum remained about 2 oz. daily and there were still repeated small hæmoptyses, especially in the winter.   A further lipiodol examination showed no change in the degree of dilatation of the branches of the left descending bronchus.

Readmitted to hospital August 1934.   Left lower lobectomy August 24.   Access was obtained by resection of a portion of the normal and regenerated parts of the seventh rib.   The lobectomy was performed by the usual technique.   The post-operative course was smooth and the patient was discharged from hospital five weeks after the operation, completely healed and free from sputum.

Carcinoma of Lung : Morcellement Removal by Bronchoscopy ; Subsequent Radon Treatment.—J. G. SCADDING, M.D. (introduced by J. L. LIVINGSTONE, M.D.).

Wilfred S., aged 31, attended Dr. Lloyd's out-patient department, May 12, 1934.

History.—Eighteen months previously had noticed a cough and shortness of breath ; a positive sputum (never since confirmed) was found by a doctor and patient was sent to a sanatorium, where he stayed for seven months without much improvement resulting.   After his discharge the shortness of breath increased, and there was pyrexia and loss of weight.   Physical signs suggested involvement of the

right upper lobe, and X-ray examination showed an opacity in this region, suggesting lobar collapse.

Bronchoscopy (Mr. F. C. Ormerod).—A pedunculated neoplasm was found, blocking the right upper lobe. Biopsy showed this to be a columnar-celled carcinoma.

Admitted to Dr. Beaumont's ward from 6.6.34 to 9.7.34; on three occasions all visible growth was removed through the bronchoscope, by morcellement. After one of these operations the right lower lobe was found to be collapsed, but on 22.6.34 the patient was very much improved, the temperature had fallen from 103° to 98·6°, and the sputum from 3 oz. to nil.

By 5.7.34 scarcely any visible growth was seen on bronchoscopic examination, and radon (5 by 1·5 mc.) was inserted directly at the site, and subsequently on 23.8.34.

Although a skiagram (8.3.35) shows little difference, the patient has put on weight from 10 st. 10 lb. to 11 st., and is at work full time.

Bronchoscopic examination now shows only a smooth elevation on the outer wall of the right main bronchus.

Section of Medicine

President—Sir FARQUHAR BUZZARD, Bart., K.C.V.O., M.D.

CLINICAL MEETING AT WESTMINSTER HOSPITAL, APRIL 2, 1935

Myelocytic Leukæmia with Retinal Changes.—D. H. DE SOUZA, M.D.

T. C., male, aged 43.   Admitted March 13, 1935.

Clinical history.—For the past ten weeks has complained of abdominal distension—particularly after meals—with occasional vomiting.   No abdominal pain.   His appetite has remained good.   His ankles have recently been swelling. During the past two weeks he has suffered from dizziness and from noises in the right ear.   On climbing stairs he has had dyspnœa and palpitations, and recently has been easily fatigued.   He has had no pains, and there have been no hæmorrhages. During the past few weeks his eyesight has been failing.   He has had some nocturnal frequency lately.   The bowels are regular.

Past history.—Discharged from the Army in 1917 with neurasthenia and bronchitis.   Nothing else of note.

Family history.—Nothing of note.

On examination.—Moderate nutrition.   Sallow complexion.   Mucous membranes pale.   Tongue furred.   Fauces healthy.   Wax in right ear.

Lymphatic system :   Several enlarged, firm, discrete glands in both axillæ. Inguinal glands enlarged.   A few small glands palpated in the left anterior triangle.

Cardiovascular system :   Heart a little enlarged.   Cardiac impulse in fifth interspace 1 in. outside mid-clavicular line.   Heart sounds healthy, with a systolic murmur at the pulmonary area.   A few distended veins over the chest wall and upper abdomen, with the blood flowing upwards ; this feature is less prominent since admission.   Some œdema of left foot.

Lungs :   Some impairment at right base.   Breath sounds diminished at right base ; râles at both bases.   No retrosternal dullness.

Abdomen :   Spleen enlarged almost to umbilicus, and very hard in consistence. The liver extends about 2 in. below the costal margin.   There is no ascites.

Nervous system :   Healthy.   Urine :   Albumin present.   Profuse deposit of amorphous urates.   No cells ; no casts ; no organisms.

Blood-count :   Hb. 30% ;   R.B.C. 2,260,000 per c.mm. ;   C.I. 0·7 ;   W.B.C. 820,000.   *Differential :*   Polymorphonuclears 15% ;   neutrophil myelocytes 70% ; premyelocytes 2% ;   transitional leucocytes 13%.

Report on fundi by Mr. A. F. MacCallan : " Bilateral hæmorrhagic retinitis. Profuse hæmorrhages, especially at macular region.   Marked degeneration of right macula.   Over the left disc is an oval transparent plaque of doubtful nature.   It may be an exudation of white cells, or more possibly a congenital condition, but is probably an organized hæmorrhage."

X-rays show enlarged bronchial glands.   Mediastinal glands appear normal.

Recovery after Amputation of Both Legs on Account of Embolism of the Iliac Vessels in a Case of Mitral Stenosis and Auricular Fibrillation.—D. H. DE SOUZA, M.D.

Mrs. F. P., aged 31, has been treated at Westminster Hospital since 1930 for mitral stenosis. She has been an in-patient on several occasions, having auricular fibrillation and congestive cardiac failure.

In May 1933, she was readmitted. She had had a dry cough for about a week, and five days before admission had had a small hæmoptysis. On the day before admission she had a sudden præcordial pain, accompanied by a rigor and great prostration. The pain was persistent, but gradually moved to the left loin, and on admission was only present on deep inspiration.

She improved steadily up to June 1 when, while on a bedpan, she collapsed with severe pain in the left leg and right side. When seen by the house physician, arterial pulsation was absent in the left femoral artery, and shortly afterwards it disappeared also from the right leg. About this time she passed some blood and albumin in her urine for several days.

Pulsation returned to both femoral arteries, but remained absent in the left popliteal artery. Within a few days both feet became discoloured and a slow gangrene set in. At first any form of surgical interference was considered impossible, and treatment consisted in controlling the severe pain with large doses of morphia. Her general condition, however, improved, and on June 24 Mr. William Turner amputated the left leg above the knee, and also the right foot. Contrary to all expectations, the patient made an excellent recovery, and was discharged to a convalescent home on August 4, feeling well.

Since then she has kept very well as regards her cardiac condition. She has recently been admitted on account of bilious attacks, apparently due to cholecystitis. Both stumps are well healed, and she is able to walk about on artificial legs.

She feels extremely fit, and her cardiac condition is satisfactory, almost two years after embolism of both iliac vessels.

Calcified Pericardium.—ARNOLD STOTT, B.Ch.

J. C., aged 29, has had a morning cough for two years. In July 1933 he had a slight hæmoptysis following a blow on the chest. In August 1933 he developed swelling of the neck, face, and upper abdomen, with giddiness and epigastric pain on deep inspiration. In December 1933 he became dyspnœic.

He was admitted in January 1934 with pain and a "rubbing sensation" over the præcordia, and swelling of the face and neck. On examination, his heart was found not to be enlarged. There was a pleuropericardial rub present, but otherwise the heart was normal. He was slightly cyanosed. The face and neck were swollen, and the veins of the neck were engorged, but not pulsating. The veins of the face became rapidly engorged to an abnormal degree when the patient stooped. There was no œdema of the legs. The liver was enlarged and firm (about 4 in. below the costal margin). Pulse 80-90. Temperature normal.

Skiagram of chest (3.1.34).—" Calcified pericardium."

7.2.34.—Patient was discharged and his symptoms were relieved for some months.

1.1.35.—He was readmitted with a recrudescence of the cough and pain in the back. On examination, the pericardial rub had now disappeared. There were signs of a pleural effusion on the left side. Temperature 98-99° F.

Skiagram of chest (21.12.34).—" Small effusion left side. Heart unaltered";
10.1.35 : " Calcified pericardium. Pleurisy with effusion left side. Hyperæmia of lungs, but no definite evidence of pulmonary tuberculosis."

The sputum was examined on several occasions, but no tubercle bacilli were found.

Coarctation of the Aorta without Visible or Palpable Evidence of Collateral Circulation.—ARNOLD STOTT, B.Ch.

Mrs. E. L., aged 41, has attended Westminster Hospital since 1933. She has complained of headaches and giddiness for about ten years, and for the past year has been breathless on exertion, and has noticed some swelling of her ankles. She states that her legs and feet are always cold. There is no rheumatic history.

The heart is slightly enlarged to the left. There is a presystolic murmur at the apex. Rhythm regular. A late systolic murmur is audible over the course of both internal mammary arteries (especially the left). A similar murmur is audible at both apices posteriorly, and these murmurs can be followed downwards to the scapulæ. There is no other evidence of any enlarged superficial anastomotic arteries. The retinal arteries are tortuous and arteriosclerotic.

The blood-pressure in both arms is 220/130 mm. Hg, and the pulses at the wrists are equal. There is very little pulsation palpable in the aorta or femoral arteries and none in the vessels of the feet.

Wassermann reaction negative.

Skiagram.—Rössler's sign (notching of the ribs) present. Hypertrophy of left ventricle. ? some abnormality of the great vessels.

Electrocardiogram.—Left ventricular preponderance ; P waves large and bifid.

Discussion.—Dr. E. STOLKIND said that for investigation of the arteries, especially when palpation proved negative, the oscillometer, being sensitive, would be useful. In cases of this kind, in which no beat could be felt by palpation of the femoral arteries, the oscillometer frequently showed a measurable persistence of arterial circulation.

Dr. F. PARKES WEBER said that, even if radiographic signs (especially notching of ribs) had been absent, stenosis of the aortic isthmus (so-called " coarctation of the aorta ") would be the most probable explanation of the absence of arterial pulsation in the feet with the high blood-pressure in the arms—much more probable than idiopathic developmental hypoplasia of the distal portion of the aorta and iliac arteries.

Basophil Adenoma of the Pituitary Gland.—W. E. LLOYD, M.D.

J. S., a girl, aged 16, was perfectly well till July 1933 when her periods, which had commenced one year previously, ceased. Since this time she has had complete amenorrhœa. About the same time, she began to put on weight. In July 1933, she weighed 9 st., and in June 1934, on admission to hospital, just over 11 st. Her only other complaint was of severe frontal headaches, which had first started in January 1934. Her past history was uneventful and her family, including two brothers and a sister, were all well.

Condition on admission.—Markedly obese and of a high colour. The fat was of a uniform distribution affecting chiefly the face and body and, to a less degree, the limbs. Slight but definite increase in the growth of hair, which was also present on the sides of the face and arms. Bluish-purple striæ were present on the arms, thighs, lower abdomen, back and chest. The heart and lungs were healthy. The blood-pressure when the patient was resting in bed, was 135/100 mm. Hg; when she was an out-patient, it had been found as high as 156/110 mm. Hg. There was a persistent tachycardia of 90-110 beats per minute. There were no abnormal signs in the abdomen or in the central nervous system.

The fundi and visual fields were examined by Mr. A. D. Griffith who reported that the fundi were normal. There was a slight peripheral contraction of the fields, especially the left; the central fields were healthy. There was nothing suggestive of chiasmal pressure.

The urine on one occasion was found to contain sugar and a trace of albumin was also once present.

Weight (December 1934) was 12 st. 5 lb.

Further investigations.—The blood-sugar curve was slightly higher than normal. The fasting sugar was 0·128 mgm. %. At 1½ hours, it had risen to 0·2 mgm. %. Basal metabolic rate + 9%.

Blood examination showed slight polycythæmia :—

	21.6.34	5.9.34	14.9.34
R.B.C.	5,190,000	5,960,000	5,640,000
Hb.	95%	104%	106%
C.I.	0·9	0·88	0·94
W.B.C.	12,200	8,300	14,200
	(Differential counts normal)		

The Zondek-Aschheim reaction was negative.

Skiagrams.—Skull : No marked deformity of the sella turcica. Long bones : No changes seen.

Treatment.—The patient has had three courses of deep X-ray therapy to the pituitary gland and has also been having small doses of thyroid extract. The headaches have been slightly less severe, but the condition is otherwise unaltered. She is still, slowly, gaining weight and at present weighs 11 st. 13 lb.

Dr. PARKES WEBER said that clinically the case was a typical one of Cushing's pituitary syndrome (" pituitary basophilia "), though there was not the discoloration, with textural alteration of the skin of the legs, which made some cases still more characteristic. Further tests for evidence of nephrosclerosis would be interesting. It seemed that the endocrine products of a pituitary basophil adenoma could actually produce nephrosclerosis, with, in some cases, ultimate death by acute pulmonary œdema. But in so-called " malignant nephrosclerosis " of any kind he understood that there was (for some reason, as yet not quite clear) infiltration of the posterior lobe of the pituitary gland with basophil cells from the anterior lobe.

Massive Collapse of the Lung Following Hæmoptysis due to Pulmonary Tuberculosis.—W. E. LLOYD, M.D.

D. D., aged 18, admitted to hospital, October 1, 1934, with hæmoptysis. His father suffers from pulmonary tuberculosis. Two brothers and two sisters are alive and well.

He had diphtheria at the age of 3, and chorea at the age of 7. He had been previously admitted in March 1930, with acute rheumatism and evidence of mitral disease. After his discharge he remained in good health until August 1934, when he had the first hæmoptysis followed by six recurrences—some copious—notably on September 29, while at work. The next day he developed pain in the left chest and became dyspnœic for the first time.

Condition on examination. — Nutrition moderate. Breathing was laboured and he was cyanosed. No œdema or clubbing. Temperature (100° F. to 103° F.) remained raised for about one month. Respiratory rate increased to 30-40 per minute for about two weeks. Left side of chest showed diminution of movement, an impaired percussion note (most marked at the base), diminished vocal fremitus and resonance. The breath sounds on left side were reduced anteriorly, but there was a small patch of tubular breathing at the base. A few râles were present and a friction rub was heard in the left axilla. A mitral systolic murmur was present.

October 2 to 5 : Hæmoptysis continued and the signs in the left lung increased, so that there was marked flattening on that side and displacement of the trachea and cardiac impulse (5 in. from midline) to the left. The diagnosis of massive collapse of the left lung was made and confirmed radiologically.

The following investigations were carried out :—

X-ray examination.—1.10.34 : Patchy density at left base, suggesting pneumonia. Heart displaced to left.

4.10.34 : Left chest completely opaque.   Heart and trachea still further displaced to left.   Left bronchus appears occluded about 1½ in. beyond bifurcation. Suggests complete collapse of left lung.

9.10.34 : Left lung aerating.   Bronchus shadow more distinct.

18.10.34 : More collapse of upper lobe.

3.11.34 : Improving at left base.   Upper lobe unaltered.

Sputum : Examined on three occasions, showed no tubercle bacilli.

Blood-count (16.10.34) : Hb. 80% ; R.B.C. 4,600,000 ; W.B.C. 8,000.

Blood-culture negative (to exclude malignant endocarditis).

Electrocardiogram.—18.10.34 : Normal.

The hæmoptysis gradually diminished, and after about one week the chest began to expand and the cardiac impulse returned to its normal position.   In view of the negative sputum tests and absence of clear evidence of mitral stenosis, the possibility of bronchial neoplasm was considered and bronchoscopy was performed (by Mr. C. P. Thomas) on November 2.   The left bronchus was shown to be patent.

On the patient's discharge (11.11.34) the left lung still showed diminished movement, and the note, particularly over the left apex in front and the left base behind, was impaired.   Bronchial breathing, numerous râles and whispering pectoriloquy were present over the left apex.   There was never any evidence of congestive cardiac failure.   The hæmoptysis had ceased and the cough had practically gone.   The patient was afebrile, but his pulse-rate remained between 90 and 100.   He had gained 7 lb. in weight.

Following his discharge, the cough and expectoration returned and became troublesome.   There was no further hæmoptysis.   The signs over the left upper lobe persisted.   His appetite became poor and he suffered from night sweats.

A skiagram on 26.11.34 showed definite infiltration of the upper half of the left lung.   The sputum on 30.1.35 revealed tubercle bacilli for the first time.

He was readmitted on 18.2.35.   Artificial pneumothorax was initiated on 22.2.35 and he has had five refills since.   His temperature, at first 99-100° F., has become normal, his symptoms have improved, and he has gained weight.   There now appears to be no evidence of mitral disease.

The last skiagram (8.3.35) shows the upper lobe to be adherent, but the lower lobe to be collapsing well.

Dr. GREGORY KAYNE said that it was of practical interest to decide from which lung the bleeding had occurred.   The fact that the hæmoptysis continued for six days after the onset of the collapse, which was associated with persistent marked dyspnœa, tended to point to the bleeding having its origin in the opposite side to that of the collapse—which would otherwise have had a salutary effect.   And, in fact, the later skiagrams, at any rate, showed definite abnormal shadows on the right side also.

With regard to the frequency of the condition, he would like to refer to B. P. Stivelmann's investigation in New York (*Amer. Rev. Tub.*, 1934, xxx, 60) of the notes and skiagrams of 5,000 patients with pulmonary tuberculosis under his care over a period of 8 years.   Only four cases of acute massive collapse following hæmoptysis were discovered, but the surprising rarity was probably due to the fact that patients who bled were not often disturbed for a careful physical examination and were rarely moved to have an X-ray photograph taken.   This condition had to be distinguished from that of chronic massive pulmonary collapse associated with chronic pulmonary tuberculosis in young adults.   The radiological picture in the latter case resembled that of unilateral fibrosis with retraction. The true nature of the former alternative should be suspected when the opposite pulmonary field was perfectly clear (as old-standing fibrotic disease was, almost always, at least partially bilateral), and its recognition was of great importance since a mistaken diagnosis might even preclude the idea of an attempt to induce an artificial pneumothorax, as it might be felt that the adhesions would almost certainly make this impracticable.

Bilateral Sweating of the Face.—W. E. LLOYD, M.D.

Violet M., aged 20, typist, has noticed sweating on both sides of the face for at least the last ten to twelve years.

The sweating is confined to the face. It is sufficient to be visible to others and to necessitate wringing out her handkerchief to mop it up. It is more obvious during the morning and early afternoon, and is usually absent in the evening.

Patient has noticed that the sight or smell of food, especially certain fruit, such as a lemon, aggravates the condition.

Past history.—Tonsils and adenoids removed, at age of 7. Measles and whooping-cough in early childhood.

Apart from the sweating, this girl appears to be healthy and no signs of disease are present. The extremities, however, are usually cold. She is becoming worried about the condition and wonders if anything further can be done. Belladonna has been tried but without any permanent benefit.

Dr. PARKES WEBER said that the sweating, preceded by blotchy flushing of the face, which was aggravated by acid fruit, reminded him of the unilateral facial flushing and sweating induced by fruit, etc., in some patients who had deep scarring (from a glandular abscess) under the jaw. He (Dr. Weber) wondered whether the operation on the tonsils and adenoids at the age of 7 years had had anything to do with the onset of the facial sweating in the present case.

Progressive Muscular Atrophy of Unusual Distribution.—J. MINDLINE, M.D. (for Sir STANLEY WOODWARK, C.M.G., M.D.).

G. H., aged 44, a bootmaker, has noticed wasting and weakness of the left lower limb for the past two years. The weakness has recently involved the left arm, and to a lesser extent, the right arm. The wasting has been progressive and has appeared in the right leg during the past few months. For the past seven months the patient has noticed burning sensations in all four limbs.

Past history.—Patient has suffered from kyphoscoliosis and right pes cavus since childhood and has worn a surgical boot for many years.

Four years ago he was examined at Charing Cross Hospital following a sudden collapse; no nervous disease was found.

In January 1933, he had an operation for a left inguinal hernia under spinal anæsthesia. Wasting was first noticed one month later. No disturbance of vision, speech, deglutition or micturition.

Family history.—Nothing relevant.

Central nervous system.—Kyphoscoliosis to left. Bilateral pes cavus. Pupils and cranial nerves healthy. Marked wasting and loss of power of whole of left leg. Some wasting of muscles of right leg, particularly quadriceps. Fibrillary twitchings present over affected muscles and in the arms. No obvious wasting of arm muscles.

Superficial reflexes: Abdominals brisk; cremasterics absent; both plantars extensor. Deep reflexes: Arm-jerks brisk; right knee-jerk brisk; left knee-jerk feeble. Both ankle-jerks absent. Sensations all healthy.

Cerebrospinal fluid, healthy. Wassermann reaction negative in blood and cerebrospinal fluid. X-ray examination of spine: Marked kyphoscoliosis with wedging of the lower dorsal vertebræ and osteo-arthritis.

No abnormal muscular reactions noted.

Mitral Stenosis and Auricular Fibrillation with Apical Cavitation of the Right Lung.—M. L. ROSENHEIM, M.B. (for Sir STANLEY WOODWARK, C.M.G., M.D.).

J. H., an engineer, aged 39, was admitted to hospital on March 6, 1935, with congestive cardiac failure.

He had had rheumatic fever " as a child " and this was said to have affected his heart.   At the age of 10 he was breathless on exercise and had palpitations.   At the age of 18 (in 1914) he was passed medically fit for the Army, but he was invalided out in 1917 with cardiac failure.   He spent the next eighteen months in various hospitals, and at one of these the diagnosis of tuberculosis of the right lung was suggested, but the sputum test was negative.   Since the War he has been in France and in 1930 was in hospital for six months on account of hæmoptysis. Since 1931 his condition has been deteriorating.

Condition on admission.—Slightly cyanosed and orthopnœic.   Veins of neck engorged ; slight œdema of ankles.   Liver enlarged and tender.   Severe cough, associated with epistaxis.

Heart enlarged to both right and left.   Auricular fibrillation.   A loud systolic murmur was present at the apex and as the patient's condition improved a mid-diastolic murmur also became audible.

No pleural effusion and only a few râles at the lung bases.   At the right apex, there was diminished movement, an impaired percussion note and all the signs of cavitation, amphoric breath sounds, increased vocal resonance, whispering pectoriloquy and coarse râles.

Since admission he has improved steadily.   The pulmonary signs are unaltered.

Electrocardiogram.—Auricular fibrillation.   Left ventricular preponderance.   T i negative.   T ii flattened.

Sputum : Negative for tubercle bacilli on four occasions.

Skiagram of chest : Heart enlarged greatly to right and left ; lungs show marked fibrosis of the right side with ? small cavities in the mid-zone.

Skiagram of the chest following injection of lipiodol shows numerous cavities in the right upper lobe suggesting the presence of right upper lobe bronchiectasis.

Diaphragmatic Hernia.—R. H. BAILEY, M.B., B.Chir. (for DONALD PATERSON, M.D.).

N. G., aged 3 months, admitted 26.1.35, having vomited since birth.   Full-term baby, born instrumentally.   Breast-fed for a few days ; then fed on half-cream milk (Cow and Gate brand).

Weight, at birth 6 lb. 10 oz. ; on admission, 8 lb. 8 oz.

Feeding the child was difficult ; it sometimes took one and a half hours over a feed.   A cough has been present since birth and, when coughing, the child vomited. The vomit contained a good deal of mucus which was stained dark brown. Constipated.

Condition on examination.—Pale but not emaciated.   No abnormal signs on physical examination.

X-ray examination.—Screening of the chest revealed a small bubble of air which appeared to be situated anterior to the cardiac shadow just above the diaphragm. The area became larger and smaller with inspiration and expiration respectively.

Investigations.—The vomit was found to contain blood.   Blood-count : Hb. 40% ; R.B.C. 4,100,000 per c.mm.   Bismuth meal : diaphragmatic hernia with a large portion of the stomach in the thorax behind the heart and to the right.

Subsequent history.—The baby vomited continuously after each feed and lost weight consistently, in spite of subcutaneous saline and blood transfusions.

1.2.35 : Seen by Mr. Tudor Edwards who advised operative intervention in view of lack of improvement.

8.2.35 : After blood-transfusion, operation was performed by Mr. Tudor Edwards. Gas-and-oxygen anæsthesia (Mr. I. W. Magill).   The stomach was found inside the thorax, together with some of the transverse colon and small bowel.   When the hernia was reduced a small hole was seen on the posterior and right aspect of the diaphragm, large enough to admit two fingers.   The stomach was found to be

too short to be completely reduced, so the walls of the stomach were stitched to the borders of the aperture at various points and the abdomen was closed.

The child stood the operation very well. Vomiting still occurred afterwards and the vomit was still blood-stained, but was less in amount and less frequent.

The child was first nursed well propped-up with pillows in order that as much of the abdominal contents as possible might be kept away from the suture line by gravity. This method was abandoned in favour of nursing the child on his face. This reduced the number of the vomits considerably and on discharge he had regained the weight originally lost.

X-ray examination.—23.2.35 : Part of the stomach still in the thorax, but less than on the last occasion. (This was only the part of the stomach left in the thorax at operation.)

Encephalitis Following Chicken-pox.—REGINALD LIGHTWOOD, M.D.

R. L., aged 9 months, had a mild attack of chicken-pox eight weeks ago. Movements of the head commenced a few days after the subsidence of the fever.

The child is mentally, and otherwise, normal. There are irregular spontaneous movements of the head and trunk. Lateral nystagmus on looking to both sides. No other abnormal signs in the central nervous system. Neither the movements nor the type of nystagmus suggests " spasmus nutans."

Eyes.—Both optic discs have ill-defined outlines and are of a depth which is thought to be pathological.

Subsequent note : The signs are gradually disappearing.

Atelectatic Bronchiectasis.—REGINALD LIGHTWOOD, M.D.

Lucy B., aged 6 years, gives a history of many attacks of pneumonia since birth. Cough has been almost always present.

In August 1933, signs of pneumonia were present at both bases, and on the patient's discharge to a convalescent home some signs persisted at the left base.

Readmitted to hospital in October 1933 with signs again of pneumonia at the left base, and a lipiodol X-ray examination showed left lower lobe collapse with bronchiectasis in atelectatic lung.

In December 1934 the child was again admitted, with signs of pneumonia at the left base. The question of lobectomy is being considered.

Discussion.—Dr. J. G. SCADDING said that in considering the advisability of operative intervention the mortality of the operation of lobectomy, which in the right hands was about 15%, had to be balanced against the risks to which the patient was exposed by the continued presence of the diseased lobe. These included further severe attacks of pneumonia, hæmorrhage, and secondary infection giving rise to fœtid sputum. The latter might lead to spread of the dilatation to other lobes of the lung, which would render operative intervention impossible. On these grounds he felt strongly that lobectomy should be performed.

Dr. ERNEST FLETCHER said that the general opinion was that a number of these cases of atelectatic bronchiectasis were congenital in origin. In this case additional colour was lent to this view by the fact that what appeared to be a tracheal diverticulum was shown on the skiagram. These diverticula were also congenital abnormalities, but were usually too small to be seen in X-ray pictures after the injection of lipiodol.

With regard to the question of treatment, lobectomy had been suggested. In a recent case of his (the speaker's) in which lobectomy had been performed by Mr. Holmes Sellors, the result had been very satisfactory. No adhesions were found at the operation, and the lobe had been removed without difficulty. Convalescence had been comparatively smooth, although the pleura had become infected. The child had had a period of treatment in a convalescent home, and was now perfectly well.

There was no question that in skilled hands this operation was the ideal treatment, and he recommended that it should be carried out in this case.

Six Cases Illustrating the Results of Sympathectomy in Abnormal Vascular Conditions.—E. ROCK CARLING, F.R.C.S.

(I) Miss E. G., aged 45.

History.—Since 1931 attacks of pain in hands and feet, with numbness and blueness.

Diagnosis.—Raynaud's disease.

Previous treatment.—(1) Peri-arterial sympathectomy (1931); (2) myoston injections (1932); (3) collosal sulphur (1933).

Operation.—18.9.34: Excision of right stellate ganglion.

(II) Miss K. C., aged 23.

History.—August 1932: Both hands blue and painful; attacks spasmodic, sometimes four or five during the day. Feet similarly, but less, affected. Frequent infection of digits.

Diagnosis.—Raynaud's disease.

Operation.—13.10.34: Left cervical ganglionectomy. 25.10.34: Right cervical ganglionectomy.

(III) Albert M., aged 49, metal spinner.

History.—Six months' pain and stiffness in left foot after walking.

Feet cold: Pulsation absent from left dorsalis pedis artery. Mottling of skin of left foot.

Diagnosis.—Thrombo-angiitis obliterans.

Operation.—15.9.34: Left lumbar ganglionectomy. Marked relief.

(IV) Frank W., aged 55.

History.—Intermittent claudication (one year). Left worse than right.

Diagnosis.—Thrombo-angiitis obliterans.

Operation.—15.11.34: Left lumbar ganglionectomy at level of L. II, III and IV.

(V) F. M., male, aged 57.

History.—Pain on walking—relieved by rest—in calf of left leg for eleven years. Eighteen months later similar symptoms occurred in the right leg, but left leg has always been the more severely affected. Wassermann reaction said to be positive in 1928, but is now negative.

Diagnosis.—(?) Thrombo-angiitis obliterans.

In 1927 left peri-arterial sympathectomy was performed at the General Hospital, Birmingham.

Condition on examination.—Left leg definitely colder than right. Pulse not felt in left femoral artery. In dependent position both feet flush markedly. A skiagram of the arteries shows no calcification.

Operation.—March 28, 1935. Left lumbar ganglion sympathectomy.

(VI) Miss D. D., aged 26.

History.—Pes cavus observed at 9 years of age. Noticed coldness of extremities for many years and was liable to chilblains on the hands. Noticed sweating of feet for eighteen months.

Condition on examination.—Generalized vasomotor instability; marked acro-cyanosis of both legs, and very cold feet.

Operation.—7.3.35: Right lumbar sympathectomy. Immediate improvement in the circulation of the right leg resulted. The difference in the appearance and temperature of the two feet is very striking and the question of a left lumbar sympathectomy is being considered.

Dr. W. S. C. COPEMAN said he had followed the operation of sympathectomy as described for rheumatoid arthritis at the Mayo Clinic for some years. This gave him much interest in the cases shown by Mr. Rock Carling. The great point seemed to be the immediate improvement in the circulation, which was often dramatic, but he was rather doubtful as to its permanence, even when the ganglia were actually removed.

Specimen : Congenital Cystic Dilatation of the Common Bile-duct.—
R. H. BAILEY, M.B. (for DONALD PATERSON, M.D.).

P. W., aged 7 weeks on admission to hospital, 21.2.35.

History.—Born with easy labour. Birth-weight 7¼ lb. Normal in colour.
Twenty-four hours later became yellow, and had remained so ever since. Breast-fed
for one month, then fed on Nestlé's milk. Had gained only ½ lb. since birth.

On examination.—The skin and conjunctivæ were jaundiced. The liver was
palpable and reached almost to the umbilicus ; it was firm and smooth. The tip of
the spleen could just be felt.

Investigations.—Mantoux reaction : 1-1,000 negative ; urine : bile present;
stools : clay-coloured. Van den Bergh reaction : Direct, negative ; direct bi-phasic,
positive ; indirect, very strong. Wassermann reaction, negative.

Blood-count : R.B.C. 3,670,000 ; Hb. 47% ; W.B.C. 12,000. *Differential*:
Polys. 23% ; lymphos. 72% ; monos. 4%. Platelets 450,000. Fragility begins at
0·4% and is complete at 0·35%. Repeated.

1.3.35.—The liver became gradually smaller, and Dr. Paterson reported that a
mass could be palpated in the abdomen in the mid-line.

A blood transfusion was given (70 c.c.).

7.3.35.—Gas-and-oxygen given for examination. Mass felt in the mid-line, rather
like a pigeon's egg. Child too feeble for active intervention.

8.3.35.—Acute diarrhœa and vomiting developed, and the child died 13.3.35.

Dr. PARKES WEBER thought that the specimen was a typical one of congenital (develop-
mental) cystic dilatation of the common bile-duct, but the early age of the patient was very
remarkable.

Section of Urology

President—J. B. MACALPINE, F.R.C.S.

[*March* 28, 1935]

DISCUSSION ON THE RADIOLOGICAL DIAGNOSIS OF RENAL LESIONS, EXCLUSIVE OF STONE

Mr. Bernard Ward: The most outstanding advance in radiological diagnosis of recent years was the introduction by Swick and von Lichtenberg, in 1929, of excretion urography, and many of you will doubtless remember the epoch-making paper read by von Lichtenberg [1] before this Section in the early part of 1931. Since then this method of investigation of the renal tract has been extensively used in many clinics throughout the country, and the time seems ripe for a discussion as to its merits and demerits.

Excretion urography may be described as the visualization of a physiological process, for it enables one to study the passage of a solution, opaque to the X-rays, through the kidney and urinary passages, purely as the result of the physiological process of excretion, which proceeds entirely unaffected by instrumentation or any other factor likely to upset its delicate mechanism. It gives us therefore an insight into the physiology of the kidney which, it is not an exaggeration to say, has completely revolutionized our ideas. It has placed in our hands a method whereby we can not only visualize the function of that organ, but also, by watching the course of the fluid as it passes through the calices, pelvis, and ureter, gain an accurate idea of any structural or physiological change in the conducting mechanism. As a method of demonstrating the anatomy of the pelvis and calices, although at times it is surprisingly good, more often it is unreliable, and fails to give that clear outline so necessary for a diagnosis. In such cases, in which the diagnosis depends on an accurate anatomical visualization, retrograde pyelography becomes necessary.

Serial skiagrams are usually taken at five, fifteen, and fifty minutes after injection of 20 c.c. of uroselectan B. The time of appearance of the shadows and any variations on the two sides are the first points of importance to be noticed. Ogier Ward [2] states that :—

"Of the serial X-ray photographs, those taken five minutes after injection are the most valuable for general purposes, for normal calices and pelvis are always visible by then ; therefore the complete absence of any uroselectan shadow at this stage indicates disease causing delay in urinary secretion."

In fifteen minutes the pelvis and calices are usually well filled, for excretion and concentration are at their highest, and the best anatomical details are obtained, and any difference in the rate of secretion and concentration on the two sides is becoming obvious.

At fifty minutes the normal pelvis is beginning to empty and any delay, especially if one-sided, suggests stasis or obstruction. In poorly functioning kidneys in which obstruction is present, radiographs will often show the excretion shadows delayed many hours after the injection of uroselectan.

We must constantly bear in mind that with excretion urography we are watching a delicate physiological process and any departure from the normal must be carefully observed and noted, especially any difference in behaviour of the two kidneys. It must not be confused with infusion pyelography, which is a purely passive delineation of anatomical outline. The correct reading of urograms can only be done by those experienced in the variations met with in the normal subject, and one is constantly meeting with fresh problems, even after examination of large numbers of cases. I believe that more mistakes are made by trying to read too much into a urogram than by reading too little.

If we are to rely on excretion urography as a method of diagnosis, we must be familiar with its limitations. It is well known that complete failure to throw a shadow occurs in a percentage of cases in health. These failures, which were frequent in the early days, have become progressively less year by year, and many of them are doubtless due to faulty radiological technique. Other factors causing failure are: stoutness of the patient, gas in the colon, too rapid excretion of the uroselectan, and excessive peristalsis, and in some cases a temporary inhibition of renal excretion. We must be careful, therefore, to recognize, when such cases occur, that it is dangerous to accept failure of visualization as evidence of disease, and in all such cases confirmation must be sought by other means, such as cystoscopy, retrograde pyelography, dye tests, and analysis of the urine.

This bilateral failure is well recognized and usually allowed for, but failure to throw a shadow on one side only is generally held to indicate poor function in that kidney. I have, however, had several cases in which the diseased side has been well shown, whilst the healthy one has failed to throw a shadow. It is true that in such cases faulty radiological technique and general factors, such as size of the patient, can be ruled out, but the other factors, such as too-rapid excretion, excessive peristalsis, and temporary inhibition of function, may easily be present on one side only, and it is well known that gas in the colon much more frequently interferes with excretion urograms on the left side. As most of the factors, therefore, favour failure rather than good delineation, I am very loth to accept, and to act upon, a unilateral negative urogram unless it has been verified by further investigation.

When unilateral failure to give an excretion shadow occurs in cases in which disease of the urinary tract—such as, for example, tuberculosis, a disease which is known to be primary in the kidney and often unilateral—has been established by the finding of pus and tubercle bacilli in the urine, one is probably safe in accepting a negative urogram as evidence of disease. But in such cases as those in which the only symptoms are unilateral pain or intermittent attacks of hæmaturia, in which the urine between the attacks is perfectly normal, in which the bladder has been proved healthy by cystoscopy, and in which the only evidence of disease is absence of the urographic shadow, I feel that retrograde pyelography ought most certainly to be carried out if possible. I have, however, twice recently been obliged to operate on two cases in which retrograde pyelography has been impossible, and although in each instance I found a growth of the kidney, nevertheless I felt very anxious until the operation had been justified by its results.

In cases of obstruction to the outlet of the pelvis or in the ureter, excretion urography is invaluable, not only in establishing the diagnosis, but in helping to estimate the degree of damage to the kidney. One must bear in mind, however, that in such cases the density of the shadow is not a true indication of function. On the one hand, stasis allows of concentration of the dye, and therefore throws a more pronounced shadow, and is likely to lead to an over-estimation of function, whereas in recent complete obstruction, the shadow may be a very poor one, or even absent, but in such cases the function of the kidney is rapidly restored to normal by removal of the obstruction. In the former case, conservative surgery might be indicated if

the density of the shadow was taken as a guide, but at operation one is often surprised to find how badly damaged the kidney really is, and nephrectomy becomes necessary.

I have found excretion urography of the greatest value in the diagnosis of those elusive and common cases of pain of renal distribution in which no clue can be obtained from examination of the urine or by cystoscopy. It will clear up many of these cases by showing varying degrees of stasis, and in others a normal urogram— whilst not allowing us to state positively that the pain is not of renal origin—at any rate rules out gross disease and makes it safe to temporize and await the course of events. It is my first line of attack in such cases, after a straight radiograph has been found negative, and it often saves the patient much instrumentation and the surgeon's time and energy.

As a means of determining the wisdom or necessity for operation in dropped kidney, it is extremely useful, and unless stasis is present in such cases, it is unlikely that operation will be beneficial. It is wise to point out that in all cases of mobile kidney one of the urograms should be taken in the upright position, as kinking or obstruction of the ureter may only occur when the kidney drops to its full extent. Braasch [3] expresses the opinion that

"If excretion urography were employed in all cases of renal ptosis in which surgery is contemplated in order to determine the degree of stasis, few operations of nephropexy would be carried out."

With this opinion I am in full accord.

Hydronephrosis.—As a rule, unless the kidney is so badly damaged as to be almost functionless, excretion urography is particularly successful in the diagnosis of these cases. Obstruction and delay in emptying of the pelvis provide ideal factors for concentration of the uroselectan, and good pictures are usually obtained, often giving surprisingly clear anatomical outline. At other times only a few dilated calices are shown, usually when obstruction is absent, at the time of examination. In the diagnosis of mild degrees of stasis, excretion urography is much more reliable than retrograde pyelography. By the latter method it is always difficult to say positively whether mild degrees of hydronephrosis are present or whether the appearances are due to over-distension of the pelvis. On the other hand, excretion urography does not always give an accurate idea of the size of a hydronephrotic kidney, and this is often better shown by retrograde pyelograms.

As a method of follow-up after plastic or conservative operations in hydro- nephrotic kidneys, it is invaluable and is often not at all flattering to the surgeon. There seems to be a wave of enthusiasm at the present time for so-called conservative surgery of the kidney, and from a perusal of the literature one would think that it was a modern discovery. I feel that if those surgeons who are so enthusiastic would carefully follow up their cases by periodical examination with excretion urography, this wave of enthusiasm would soon decline.

Ureterectasis.—Ureterectasis is well shown on the excretory urograms when obstruction is present with dilatation above. The normal ureter is rarely visualized in its whole length; usually only the upper third, or more rarely the lower third alone, being filled, and commonly these show peristaltic waves. If obstruction is present there will be dilatation above the obstruction, with narrowing at its site. We have heard a great deal about stricture of the ureter during the last few years, but in my experience it is a very rare condition, except after direct injury at operation or as a late result of the impaction of a stone.

If excretory urograms were made and only those cases in which stasis was present were treated, I feel that dilatation would be needed in only a few cases.

Urinary tuberculosis.—Excretion urography is invaluable in helping one to get rapidly an idea of a case in which tuberculosis has been established by examination of the urine. The diseased side is usually well shown and the characteristic

appearance of ulceration of the calices and cavitation in the cortex, together with dilatation of the ureter, makes the disease on that side certain. The entire absence of a shadow on one side is also fairly conclusive evidence of extensive disease. These findings enable the surgeon to concentrate his attention on the supposedly sound side and save the patient much instrumentation. Anything which does this in these distressingly difficult cases must be a very great gain both to the surgeon and his patient. The presence of a normal excretion does not exclude the presence of tuberculosis. In such cases it very rarely happens that we get such accurate anatomical delineation of calices that we can with certainty say that no disease is present. In all such cases it is my strong opinion that it is essential for retrograde catheterization of the supposedly sound kidney to be carried out and the catheterized urine examined for pus and tubercle bacilli. I do not consider a retrograde pyelogram as safe evidence of the absence of disease in such cases. I believe that the presence or absence of pus in the catheterized urine is the most delicate test of all. But supposing catheterization of the ureters to be impossible, as it not infrequently is in severe ulceration of the bladder, can we safely rely on the urograms? I feel that in doing so we must be taking a risk, but in certain cases it may be a justifiable one. If, for example, the renal function tests are good, if excretion of blue is normal, and if there is no change in the ureteric orifice to raise suspicions, one may take the risk; but if function tests are poor, if excretion of blue is bad, and there is ulceration of the ureteric orifice, one ought to hold one's hand despite a normal excretion of uroselectan on that side.

It is very useful in the follow-up of cases in which nephrectomy has been performed on account of tuberculosis, and in many of these in which the bladder remains severely ulcerated and in a state of almost continuous spasm, it has been shown that hydronephrosis of the healthy kidney is not uncommon and may kill the patient from uræmia without that kidney becoming infected with tuberculosis. Excretion urography demonstrates these cases with absolute clarity.

Tumours of the kidney.—Intravenous urography is unreliable in the diagnosis of renal tumours, because it so often fails to give an accurate anatomical delineation of the pelvis and calices, and it is on this that the diagnosis usually depends. Retrograde urography is undoubtedly the method of choice in such cases and will demonstrate early changes in the shape and size and any filling defects which may be present, and it is far more reliable. Wade [4] has drawn attention to a point which I have also observed, namely, that in diffuse carcinoma of the cortex of the kidney, filling defects and alterations in shape of the calices are often absent, and that in such cases function is interfered with before anatomical outline. In such cases retrograde pyelograms will fail, but excretion urography, by failing to give a shadow, will demonstrate loss of function caused by infiltration of the kidney with cancer cells. Wade further states that, "The degree of malignancy varies inversely with the degree of demonstrable renal functional activity, as shown by urography." Although this statement contains a germ of truth I am afraid it will not be generally accepted. I have quite recently operated on two cases in which intravenous urography failed to show any functional activity of the kidney on the diseased side, but in each of these the actual destruction of kidney tissue was comparatively small and the tumour was a localized one without any infiltration of the surrounding healthy tissue.

Renal back-pressure and prostatic obstruction.—I had hoped, when excretion urography was first introduced, to have in it a reliable method of estimating renal damage in cases of prostatic obstruction, but unfortunately my hopes have been completely shattered by our results. In 80% of the cases we have failed to get a satisfactory urogram, and my visions of estimating the damage in such cases, by a graphic record of the varying degrees of back-pressure and dilatation of ureter and kidney, have faded into the background.

Young [5] has had the same experience in cases which have been catheter-drained on account of back-pressure, and in which the usual function tests have been restored almost completely to normal. In such cases he has found the elimination of uroselectan greatly delayed and diminished, resulting in very poor and indistinct urograms. Dean and White, working in his clinic, estimated that the quantity of uroselectan in the urine is less than normal and greatly delayed in reaching its maximum concentration. In such cases, therefore, the excretion of uroselectan is a more delicate test of renal function than the tests usually employed. Excretion urography will, however, occasionally demonstrate back-pressure in an early case before it has been otherwise suspected and thus afford valuable information on which advice as to the advisability of operations can be based.

In the follow-up of cases in which the ureters have been transplanted into the rectum or colon, intravenous urography is the only available method which will give us accurate information as to how the kidneys are progressing. In the pyelitis of pregnancy, it gives valuable information on which to base one's advice as to the conduct of such cases. In the differential diagnosis of abdominal tumours, it is often of great help, and in all cases in which retrograde pyelography is impossible or contra-indicated, it is invaluable.

Excretion urography is a very great advance on anything that has gone before. In the short time during which it has been available it has established itself as one of the most important aids to diagnosis which the urologist has, and it enables him easily, and without pain or inconvenience to his patient, to establish a diagnosis in many cases which previously must have remained in doubt, or only been finally elucidated by extensive instrumental investigation. In the unravelling of some of our problems it stands alone.

In closing my remarks, let me remind you, however, that radiography is only a link in the chain of evidence, sometimes a strong one, at others a weak and unreliable one. It must at all times be taken in conjunction with the clinical evidence available and often must be supported and verified by instrumental examination, before its findings can be accepted. Under no circumstances should the radiographic report be communicated to the patient. The surgeon or physician is the only person who is in possession of the clinical facts and findings, and is therefore the only one who can interpret and attach the correct importance to the radiographic findings.

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Mr. G. R. Mather Cordiner: In the majority of cases of long-standing and recurrent renal infections, definite evidence will be shown by excretion urography. Only in a small percentage will its complementary examination, ascending pyelography, be necessary in order to arrive at a diagnosis.

In acute renal infection excretion urography shows no evidence of the opaque medium in the pelvis or calices or, at best, shows only a fleeting, incomplete filling, but a good shadow of the medium is obtained in the bladder. Such cases, if re-examined after an interval of a few weeks, and if infection has subsided, will show a normal picture. In an acute exacerbation of a chronic condition, the changes of chronic infection will be shown.

The inflammatory lesion may be confined mostly to the pelvis or mostly to the parenchyma. This division is, of course, purely arbitrary, but from the radiographic point of view it affords a reasonable classification on which to base the interpretation of the radiographic changes.

In those cases in which the infection predominates in the pelvis the earliest changes seen are dilatation of the calices, dilatation of the pelvis, and dilatation of the upper portion of the ureter. One or more of these changes may be present in any given case. In an ascending pyelogram the calices show a loss of the terminal irregularities. They are clubbed, and there is a varying degree of dilatation and elongation of the isthmus. It is characteristic of an inflammatory dilatation that the calices are not symmetrically and equally enlarged. In the intravenous pyelogram the terminal irregularities may be lost, but as a rule the clubbing is not nearly so marked as in the ascending pyelogram. More commonly, the terminal irregularities are still present but they have lost their sharply defined outline. They appear hazy and indistinct, as if the patient had breathed, or as if there had been slight extravasation of the medium, whilst the rest of the image of the pelvis and calices is sharply defined. There is also some elongation of the calices.

In many of these cases there is also a definite dilatation of the first inch or two of the ureter. This inflammatory dilatation is constant and persists unchanged on every radiogram throughout the examination. Below this dilatation the ureter may be normal or may be irregularly contracted. That this dilatation is not the result of an obstruction is proved by the absence of back-pressure changes in the pelvis and calices. In a normal pyelogram one may sometimes see a similar apparent dilatation of the ureter, but this is not found on every film. In the inflammatory condition it persists throughout the examination and is present in all radiograms.

In some cases the only visible change is a dilatation of the pelvis, with an alteration in the pelvi-ureteric angle, which becomes more acute. Although at first sight in these cases there appears to be a normal wide angle between the pelvis and the ureter, on close inspection a definitely acute angle between the pelvis and the ureter can be made out, masked by the overlapping of the dilated pelvis.

In these cases there has been an extension of the inflammatory process outside the pelvis proper, and adhesions between the pelvis and the ureter have resulted. Even when the infection has passed off, the dilatation of the pelvis persists, because of the obstructive element which is now present. Of course with an ascending pyelogram the dilatation in such cases is much greater than in the intravenous pyelogram, but this is due to an artificial back-pressure.

As a rule at this stage there is little or no interference with the function of the kidneys as demonstrated by the time of the appearance of the opaque medium. With the addition of this obstructive factor a progressive dilatation takes place, resulting in varying degrees of hydronephrosis. The inflammatory hydronephrosis, in contrast to the purely obstructive type, never reaches such a large size, and is much more irregular, and the unequal dilatation of the calices persists. An intravenous pyelogram will usually indicate the infective nature of the dilatation because, on the opposite side, infective changes are also present.

The differentiation of the inflammatory from the purely obstructive type of hydronephrosis of high degree can be made from the fact that in the obstructive type compensatory hypertrophy takes place in the opposite kidney as the hydronephrosis advances. Incidentally, it is well not to mistake this physiological hypertrophy for a pathological dilatation. The compensatory hypertrophy shows a uniform enlargement of the normal image of the pelvis and calices and there is an associated enlargement of the renal shadow.

The characteristic of the type which has been considered is dilatation, whilst the characteristic of the other type is contraction. In the parenchymatous group the inflammatory attack is concentrated chiefly upon the kidney substance. The result of the inflammation in the kidney tissue surrounding the pelvis and calices is fibrosis and subsequent contraction; this involves the calices and they become shortened, contracted, and distorted. At the same time the pelvis may be markedly shrunken and deformed. Of course in any given case both types of changes may be present.

These cases of cicatricial contraction of the pelvis and calices are amongst the most difficult pyelograms to interpret. The conditions from which they have to be differentiated are essentially new growth and tubercle. A neoplasm which has advanced to a size sufficient to produce such a deformity of the pelvis and calices will of necessity have destroyed the renal function, and no image at all will be obtained by intravenous pyelography. A normal intravenous pyelogram will exclude new growth. Either there is no function on the affected side or else one of the classical deformities will be seen.

The differentiation from tuberculosis is usually possible. The characteristic feature of tuberculosis is the presence of cortical necrosis. Although this may occur in pyelonephritis it is relatively uncommon. When tuberculosis has advanced sufficiently to produce a cicatricial deformity comparable to that in pyelonephritis, the kidney function will have ceased and in this stage typical tuberculous changes will be seen in the ureter and in the bladder.

Mr. H. P. Winsbury-White: Dr. Cordiner has called attention to some very important points regarding early radiographic changes in the kidneys.

Ever since the introduction of the intravenous method of urography I have noted many cases in which there existed prostatic or bladder-neck infection in the male, or infection of the cervix uteri and bladder-neck in the female, accompanied by mild degrees of dilatation of the renal pelvis and upper part of the ureter. I interpret these signs as inflammatory and ascending in origin.

Many of these cases are associated with symptoms related to the upper urinary tract and the symptoms disappear, or are alleviated, on treatment of the inflammatory condition below. It is striking to notice in the series of skiagrams taken of one patient how a lack of definition in a single calix, or in a group of calices, will persist in all the films. It is difficult not to believe that these facts imply a localized area of impaired renal function. Moreover it is evidence which cannot be elicited with the retrograde method of pyelography, as the pressure with the syringe will force the fluid into all the calices.

Section of Neurology

President—S. A. KINNIER WILSON, M.D.

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[*March* 21, 1935, *continued*]

Some Observations on Apraxia

By W. MAYER-GROSS, M.D.

IN spite of the enlargement of our knowledge of aphasia and agnosia by the study of head injuries during the Great War, the doctrine of apraxia has not received any great stimulus from these observations.

It remained at the stage Liepmann arrived at in the first ten years of this century until Kleist described a new form in 1922. In this, patients who are able to perform all purposeful activities in daily life fail or have difficulty in making simple patterns with mosaics, matches, bricks, in copying drawings, and sometimes in writing—in short, in all constructive tasks.

Kleist speaks of "constructive apraxia," and Strauss, his pupil, published a large number of cases to demonstrate the independence of this from the other forms of apraxia. He also pointed out the independence of constructive apraxia from gnostic, especially visual, impairment. The close connexion with visual functions and with the cases described by Poppelreutter as optic apraxia is admitted. If one had to give the theory of Kleist in a few words, one would say: that the visual control of activity in space fails in constructive apraxia. There are relations to agnosia in space, as described by Gordon Holmes and his collaborators and by Best. The localization of the disturbance in parts of the parietal lobe, where optic, tactile and praxic functions are connected with each other, seemed to be in favour of such a theory, although a real visual dysfunction could not be proved in the pure cases by the means then available. The description of a symptom-complex by Gerstmann in 1924 brought fresh interest to the problem. He put forward agnosia of the fingers as the central symptom of a parietal symptom-complex. The symptoms of this complex are difficulty in naming and using the fingers, and in discriminating right and left, agraphia and arithmetic difficulties (acalculia).

Very soon it became clear that the Gerstmann-syndrome was occurring in the same people as Kleist's constructive apraxia and a rather extensive literature grew up in Germany. Most papers dealt with one case only in which careful investigation had thrown light on one or another side of the syndrome.

I do not propose to deal with the different theories to-night. I would only mention an outstanding paper of Lange, who summed up his explanation of a very interesting case in the statement: "The category 'direction in space' is lost." The patient can perceive objects in space and act with the objects purposefully. But where she has to create points of relation in space and must fix directions, she fails. Finger agnosia, disturbance in discriminating right from left, difficulties in drawing and arranging, and eventually acalculia are reduced to space disturbance by Lange. In spite of its nucleus of truth this explanation seemed to some extent artificial and Lange himself has weakened its value in later publications.

Before I report the six cases which I have had the opportunity of observing during the last year in the Maudsley Hospital, while working there as a Commonwealth Fellow, I would like to mention a discrimination made by Rieger so early as 1909, which is noteworthy in this connexion. He discovered in a large number of patients with general intellectual deterioration two groups : in the first group the verbal and symbolic apparatus, as he calls it, was mainly affected; in the other group the spatial and objective apparatus was affected while speech and symbolization were relatively unimpaired. The patient could help himself in difficulties of the spatial world of objects by using familiar verbal and conceptual devices. Rieger also was the first to show the helpless behaviour of patients of the second group if confronted with simple spatial tests like arranging matches or single letters.

Although the things we have to deal with are not quite new, the relation to other dysfunctions following organic brain lesions is still difficult to assess. Opinions differ considerably as to the relation of constructive apraxia to Liepmann's apraxia and its different forms.

My contribution to this problem to-night will be a film. In it the contrast will be illustrated by a patient with Liepmann's apraxia who performed easily the constructive tests which are so difficult for my patients with constructive apraxia.

Case	Bodily findings	Memory speech	Visual impairment	Apraxia	Finger-agnosia	Right and left disturbance	Agraphia	Arithmetic	Drawing
Bo.	Spastic signs left side	Amnesic syndrome, word-finding difficulty	Visual attention impaired	Constructive slight ideomotor	Present	Present	Present	Only orally	Impossible
Ri.	Weakness left	Amnesic syndrome, lack of initiative	Visual attention impaired	Constructive slight ideomotor	Slight	Absent	Present	Only orally	Poor
Pa.	Spastic signs left, akinesis right	Amnesic syndrome, lack of initiative	nil	Constructive slight ideomotor	Present	Present	Present; can write block letters	Acalculia present	Very poor
Cl.	nil	Amnesic syndrome, later improvement	nil	Constructive	Present	Present	Slight	Acalculia slight	Disturbed
Be.	nil	Amnesic syndrome, lack of initiative	nil	Constructive	Slight	Absent	Present	Only orally	Disturbed
Ba.	nil	Amnesic syndrome	nil	Constructive	Present	Present	Very slight	Total acalculia	Slightly disturbed

FIG. 1.—Table of cases and chief symptoms.

With five of my six patients the illness began at about the age of 50. A slowly increasing mental deterioration became manifest. Memory impairment, loss of interest in things around them, inability to find their way, were the first signs observed by relatives. The patients could not read the clock-face, they lost the faculty of writing and doing arithmetic and they made gross mistakes in dealing with money. Men failed in their profession, women had to give up their housework. In only one of these five cases is there a history of slight apoplectic seizures with one-sided weakness. In all others the process of deterioration began insidiously and progressed without any acute phases.

The sixth case (Cl., *see* fig. 1), that of a woman, aged 63, showed constructive apraxia following a severe carbon-monoxide poisoning. After a year's depression during which she made several attempts at suicide, she succeeded in gassing herself. She is said to have been unconscious for over sixteen hours. But the amnesic syndrome, which was stationary or progressive in the other cases, diminished in this case, while constructive apraxia and other parietal symptoms persisted a long time.

The question of localization is far from being definitively answered. I cannot contribute much towards its solution because so ·far I have ·been able to examine the brain of only one of my patients and this showed multiple softenings in different parts of both hemispheres (Pa. fig. 1). The frontal and occipital lobes were free from macroscopic changes. A large deep area of softening was situated in the lower part of the left parietal lobe, a smaller one in the corresponding part of the right side. On microscopic examination of the corpus callosum Dr. Alfred Meyer found softenings there too.

The *neurological findings* were very few. In three cases slight pyramidal signs of the left side were found, but no definite paresis. One of these patients showed slight spasticity of the left side, but preferred to use the left hand although right-handed from childhood. There was an akinesis of the right hand which he could use to the same extent as the left if the left was fixed. Apart from these findings I discovered no disturbance of the lower motor neurone, no ataxia, no tremors and no hyperkinesis. The constructive apraxia was throughout a bilateral syndrome in my cases (as it is in nearly all the cases in the literature).

The sensory functions also were normal throughout. All modes of skin-sensation proved intact; there was no disturbance of sensibility of joints and muscles and no astereognosis, which has sometimes been made responsible for the finger agnosia of which I shall speak later.

Testing the visual functions was especially important for theoretical reasons. None of my cases showed hemianopia or scotomata. In the two most severe cases (Bo. and Ri. fig. 1) there was in some degree a slow excitability of visual attention, perhaps similar to that found in cases of parietal head injuries published by Gordon Holmes. In one of these two cases the reaction to auditory stimuli was much quicker. The other patient reacted generally rather slowly, so that the particular disturbance of visual attention was doubtful. In none of the cases was any sign of optic agnosia found, or of optic ataxia in the sense of Balint, and no disturbance of visual localization as described by Best. All the patients were able to count visually. Optic nystagmus was present in the five cases tested, but was rather difficult to excite in the two cases with attention disturbance.

With regard to the *general mental state*: all my patients had a more or less severe impairment of memory which had to be taken into consideration, especially in testing arithmetic. The form of memory disturbance showed the typical picture of early senile or arteriosclerotic deterioration: numbers and dates were most affected, and then names. In the most severe cases considerable defects of recollection of former life were present. The gassed patient (Cl.) had retrograde amnesia. Retention-difficulty was present in all patients, with no selection or preference, when tested with different sensory stimuli.

Corresponding to the degree of memory disturbance, a slight difficulty in finding unusual words was demonstrable, but in most cases only on very rare occasions. On the whole the lower and higher speech function was—in contrast to the other activities—very well preserved: there was no amnesia for colour names, and there were no difficulties of speech-perception, or disturbances of music or rhythmic sense.

As to the *form of apraxia* found in my patients, the series can be divided into two equal groups. In the first, slight disturbances in purposeful activities were sometimes

present.   Simple everyday actions, e.g. lighting a candle, using pincers, scissors, hammering nails, were carried out without difficulty.   Tests of greater spatial complication were sometimes impossible ; e.g. tying up a parcel, putting on a shirt—especially if done without visual control—tying a bow or brushing one's hair while holding the mirror.   I doubt if these failures in my first group, although apparently ideomotor in Liepmann's sense, are really to be regarded as such.   The connexion with the constructive anomalies of spatial activity is obvious.   The fact that these cases were those in which the disturbance was more severe, agrees with my interpretation.

The second group showed only constructive apraxia.   According to Kleist's definition constructive apraxia is a " disturbance which appears in formative activities (arranging, building, drawing) and in which the spatial part of the task is missed although there is no apraxia of single movements."   For example, I asked the patients to arrange matches in simple figures, such as a square, a triangle, a rhombus, a house ; or as Roman numerals.   Then I placed before them rectangular figures, gave them the corresponding number of matches and asked them to copy the pattern.   The patients always began readily enough but, even in the mildest cases, failed if the figures were complicated.   The difficulties they were struggling with were expressed in a very typical manner.   As soon as the patient was unable to go on, he brought his own matches as near as possible to the pattern or tried to build his copy into it, so that he soon mixed the matches of the pattern with his own matches and became muddled.

The same difficulties and the same behaviour can be observed in tests with coloured mosaics of different shape.   The patients repeat the task to themselves aloud or name the colours of the mosaics again and again in correct order, but they do not get any help in this way.   They recognize their failures and begin again nearer to the pattern.   One is really impressed when one sees how a patient, who is able to choose from a pile of mosaics the correct pieces to fit a given pattern, is yet absolutely helpless when he tries to arrange them in the same order as in the model.   With bricks, the fact of their being of three dimensions seems to increase the difficulty.

Imitation of hand-and-finger postures is similarly difficult.   Patients were able to imitate the posture of one of their own hands with the other, but in copying the position of the doctor's hand they failed, or succeeded only after long trial.   Here too the tendency to come close to the pattern was evident.   A striking contrast was the relatively easy and correct imitation of postures of other parts of the body.   All patients imitated postures of the head, the trunk, the arms as a whole, and the legs fairly correctly and without delay.   They were able to walk to any place in the room if ordered, avoiding obstacles, choosing the easiest way.   They also, on request, pointed at objects or grasped them, without any error in direction and distance.

The notions of direction : " above " and " below," " in front " and " behind," were preserved ; those of " horizontal " and " perpendicular " were doubtful in the three more severe cases.   Four of the patients were completely, and the two others (Ri. and Be., *see* fig. 1) partially, unable to use these words and to find the directions right and left.   These four were quite uncertain in naming the two sides of their own body or any symmetrical parts of it.   They made random guesses.   It was still more difficult for them to distinguish the sides of their image in a mirror or to do this for a person sitting opposite.   The latter task was impossible for the two other patients, who had less difficulty with regard to the sides of their own bodies.   It is an interesting fact in this connexion that my patients had great difficulty in using a map, especially in indicating the points of the compass.

Inability to tell the time had been observed in these patients by their relatives. Four of the patients (two of whom had not the marked right-left disturb-

ance) could not read the time from a clock or put the hands of the clock so as to correspond with another (Head's test); nor could they alter a clock in response to oral command. In one patient (Ri.) the disturbance appeared only occasionally and in another (Ba.) it was entirely absent. The patient with the least disturbance in constructive tasks was quite helpless with the clock-test, but he had a severe arithmetic disturbance. This perhaps suggests a relation to acalculia which I shall speak of presently.

A dependence of the so-called *finger agnosia* on the right to left disturbance, or vice versa, is demonstrated in my observations : inability to name one's own fingers correctly, to show single fingers if asked, or to point to the fingers of the doctor, was most marked with the four patients whose right to left discrimination was affected. Thumb-and-little-finger-tests, as other observers have noted, presented less difficulty ; there were only a few failures. The more severely affected patients became really muddled with their fingers after being investigated for a short time.
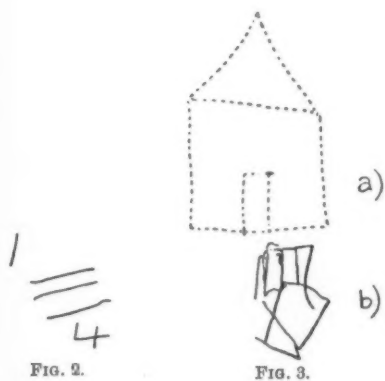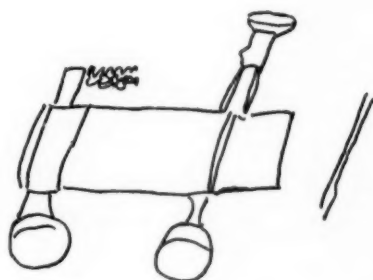

FIG. 2. FIG. 3. FIG. 4.

FIG. 2.—Case Bo. Drawing a square. Patient made the four strokes while counting 1, 2, 3, 4, then wrote the figure 4.

FIG. 3.—Case Cl. Copying a house: (a) pattern ; (b) copy.

FIG. 4.—Case Pa. Drawing an engine. After finishing the engine patient was asked to add the tracks. He then put the two strokes alongside.

Drawing-disturbance was very marked in five of my cases and I think Kleist is right in bringing it into line with the constructive tasks. A former school-teacher refused to draw anything at all. After wearisome persuasion he drew a very small cross and circle, rather imperfectly. Others tried to draw, but with very poor results. Simple drawings were copied extremely badly ; mostly the single parts were more correct than the spatial order of the parts. The tendency to come close to the pattern was again very striking ; the copy was often put into the model.

The drawing-inability of a former famous artist in stained-glass whom I had the opportunity to observe was of the greatest interest (Pa., figs. 4 to 7). Although the handling of the pencil was quite normal, the destruction of his drawing faculty was almost incredible. Even his placing of the drawing on the sheet of paper demonstrated the severe spatial disturbance. Some lines and some fixed schemata in designing disclosed the professional hand, otherwise his drawings were like a child's (*cf.* Kleist). He also tended to put his drawings into the pattern (fig. 7).

Before I speak about the *agraphia* in these cases I would like to emphasize that reading was quite unaffected in all my patients. All could read with correct accentuation according to the sense, and understood what they read. Some of them occasionally lost a line, but if they were aided by a pointer this was avoided. Reading of numbers with three and more digits was impossible for the patients, who no longer knew their local value. All the patients spelled correctly and chose the single letters of a given word out of a pile of letters, but failed in putting the word together. The most striking case was that of a former teacher who proved unable to add the third letter of a word like D O G in correct position when the two first letters were set before her.

Yet the patients noticed if a letter was misplaced or set upside down, but they were, of course, unable to put it right. This "printing disturbance" is perhaps closer to the constructive difficulties than to those of writing—both defects are summated in it.
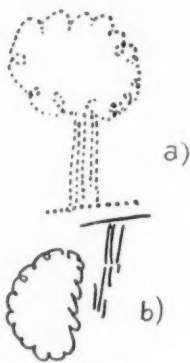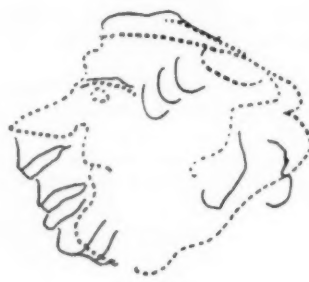

FIG. 5.   FIG. 6.   FIG. 7.

FIG. 5.—Case Pa. Drawing a tree. Patient drew the leaves. Then when asked to draw the trunk he drew the circle alongside.

FIG. 6.—Case Pa. Copying a tree: (a) pattern; (b) copy.

FIG. 7.—Case Pa. Copying a face (pattern shown by dotted lines). Patient began at once to draw actually on the pattern. He was at a loss when asked to copy it alongside the pattern and came back to the pattern; see the perseveration in his drawing.

In observing the *writing*, the patients' relatives were surprised at the arbitrary use of the space on the sheet; the patients seemed to begin anywhere. When they had begun they tried to scribble all the words within a very narrow area without regard to the space available. Experiments showed that the starting place was not chosen at random. The patients seized on some little spot, e.g. an unevenness in the paper or a watermark, as their starting point. If I made a small scribble on any point in a large sheet of plain paper or on a blackboard, I could be sure that the patient would begin his writing there. If they were urged to write somewhere else, the patients, on some occasions, approached the spot by directing the line of their writing towards it.

The agraphia is never complete. In one case (Be.) the writing disturbance was very slight—being neither literal nor verbal—but it was characterized, again, by a space factor. I would not venture to say it was *caused* by this factor. Rarer letters like *k* and *y* were ill-formed because of obvious space difficulties (*see* fig. 10). The

FIG. 8.—Case Bo. Arranging the word DOG with wooden letters.

FIG. 9.—Case Bo. Writing of name, address, alphabet, sequence of numbers.

FIG. 10.—Case Be. Writing the alphabet, see failure with letters like K and Y, because of unfamiliarity and spatial difficulties.

order of letters also seemed the main impediment in writing words. Yet I am not sure how far Kleist's conception is right. He assumes a distinct constructive agraphia. The artist in stained-glass was quite skilful in writing block letters, whereas in cursive writing he failed much more often.

It impressed me as very peculiar that patients seemed less aware of their errors in writing than of their other failures. They tried to escape into writing words if they found difficulty in drawing or putting together a number of digits. This was most striking in one of my patients who regularly escaped into writing when asked to draw.

In order to illustrate the *arithmetical disturbance* which appeared in all my cases to some extent and dominated the clinical picture of one of them (Ba.), I would quote the findings in a clerk who had been an accountant in a printing firm for about thirty years before he fell ill (Ri.). He did simple mental arithmetic quite well and quickly so far as his memory defect did not interfere with this. He knew his tables, could do addition and subtraction and compute simple interest. In writing he was helpless, even with simple addition. With some help he succeeded in adding simple columns, but was not able to write down the figures in correct order. The local value of the figures was entirely lost. This patient wrote 105 as follows : 1.5. Others wrote in the word "hundred."

Fig. 11.—Case Pa. Writing: unable to write his surname in cursive script, though successful with block letters. Spatial difficulty leads to running words together.

FIG. 12.   FIG. 13.

Fig. 12.—Case Ri. A written sum, single columns are added correctly but proper alignment is impossible.

Fig. 13.—Case Cl. A written sum. Correct answers misplaced.

Most of the patients could not manage money. Although they could count the number of coins they failed in handling and putting in order coins of different value and in adding them.

I must now cut short the narration of facts in order to add some remarks by way of interpretation of the syndrome of apraxia, which I have been describing. Many of the observations, thus roughly described, suggest that *space-impairment* is the cause of these disturbances; other writers have taken this for granted. I hesitated, however, to agree with this suggestion at first. Space is a very wide and vague notion; every activity, every movement, occurs in space. Any disturbance of activity can therefore be looked upon as a space-disturbance or as conditioned by some disturbed space-factor. There are anomalies in visual, auditory, tactile space and systematic space anomalies of vestibular origin. How can we specify the space-disturbance in constructive apraxia? Is it possible at all to specify it?

If we call the sphere in which every action is carried out its "activity-space" ("Wirkraum" v. Uexkuell) then activity-space is not generally affected in constructive apraxia. Purposeful activity is possible, the underlying space-perception by sensory means and the notions of space-relations seem nearly all well preserved. The disturbance is present preponderantly *in the small realm of hands and fingers* and in all performances dependent on these. Here all functions concerned with positions, movements and notions have become uncertain.

Moreover one finds here the peculiar tendency mentioned above, which has also been noted—as a casual observation—by different writers. Goldstein described it, but without recognizing its connexion with activity and apraxia. But its wide range and fundamental significance had not been established. Teleologically we might speak of a fear of empty space. During any manual performance the hand pushes away from loneliness, as it were, it tries to find company in anything that fills up the space. In rhythmic movements the hands tend towards one another. I have observed the same thing in gymnastic exercises. One patient was bending forward towards the doctor, who was showing her how to do the exercise, apparently in order to get closer to his hands. I recall the behaviour in writing, drawing, in imitating finger postures, in copying mosaics—always the hand tends to go out of the empty towards the filled space. As frightened chickens flock together, so do the active hands go closer to the pattern or anything else that fills the space. The tendency gets stronger and more manifest in proportion as the spatial task appears more difficult. The spontaneity and promptness of this symptom gives one the impression of a *primary biological protective mechanism,* like perseveration. To give a preliminary name, may I propose to call it the "*closing-in*"-symptom? Its occurrence seems to me an important and essential support of the interpretation of constructive apraxia as space disturbance, and makes its functional analysis easier. Looking over the literature, and considering the reported observations, one can scarcely believe in a disturbance of space as a "category." Nor does a separate impairment of direction in space seem probable. All three space qualities are affected in our syndrome—direction, extension and localization: e.g. right-left disturbance and inability to keep to the line in writing can be mainly regarded as disturbance of direction. The closing-in symptom is certainly a sign of injury in space extension; localization-factors are disturbed in copying mosaics or "printing" tests, in the loss of local value of figures, etc.

Thus the space disturbance is a general one, comprehending all qualities of space. Still it is special in so far as it concerns only the "activity-space," and this only in the sphere of hands and fingers.

Such a partial disturbance seems to be less astonishing and peculiar if one assumes that capacity for action in space reaches its finest differentiation in the activity of hands and fingers. The human hand has scarcely any spatial fixation point; it can be moved in almost all directions, and in a larger extension than any other part of the body. The movements of the eyes, which are perhaps of a comparable delicacy, take place in a more organized and controlled part of space because of the fixation of the eyes in the skull. Their co-operation with head- and

body-postures is guaranteed by numerous reflex mechanisms (Magnus and de Kleijn). Thus the highly differentiated activities of hands and fingers can be said to be the most vulnerable part of the human " activity area."

In constructive apraxia this maximum performance is reduced.

Beginning from this conception a new approach to the study of other space disturbances seems to be possible. We ought to know how far visual space impairment influences " activity-space," and how the different functions concerned with space are working together.

I conclude with an allusion to the importance of relating the results of such investigations to genetic research into the development of space appreciation in childhood and in animals.

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Section of Obstetrics and Gynæcology

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A Follow-up Survey of the Cases of Hydatidiform Mole and Chorion-epithelioma treated at the London Hospital since 1912

By ALAN BREWS, F.R.C.S.

THIS paper is based on a consecutive series of 72 cases of hydatidiform mole and 16 cases of chorion-epithelioma obtained from the obstetric, gynæcological, medical, and surgical case-records of the London Hospital. Some of the cases of hydatidiform mole subsequently developed chorion-epithelioma and these are included in the latter series.

HYDATIDIFORM MOLE

Ætiology.—Only one case (Case 5) throws any light on the ætiology of hydatidiform mole. The patient, aged 30, had three children, the youngest eight years ago. Her last normal period was fourteen weeks before admission, and she was admitted because of vaginal hæmorrhage for nine weeks. After two weeks' conservative treatment in hospital, it was decided to induce abortion surgically, as vaginal bleeding persisted. This was done by inserting laminaria tents and packing the cervical canal and vagina with sterile gauze. After forty-eight hours the patient spontaneously aborted a fœtus attached to a complete normal placenta and, in addition, a hydatidiform mole, which appeared to be entirely separate. The original mole was considerably larger than the placenta attached to the fœtus. This case definitely suggests that the factor inducing the formation of hydatidiform mole lies in the ovum rather than in any abnormality, endocrine or otherwise, of the mother. Madame Boivin, Birnbaum, Falgowski and Lukens, amongst others, have recorded similar cases in the literature.

Age Incidence.

Patients under 20 years		..	..	..	..	2
,, 20-29 years	..	..	..	..	..	26
,, 30-39 ,,	..	..	..	..	..	17
,, 40-49 ,,	..	..	..	..	..	19
,, 50 years, or more	..	..	..	..	8
						—
						72

It is of interest that 27 patients were over 40 years of age, i.e. 37·5%.

Previous Pregnancies.

Primigravida ..	..	..	..	..	..	17
1-10 children ..	..	..	..	..	..	39
Over 10 children	..	..	..	..	..	10
No notes of previous pregnancies		..	..	..	6
						—
						72

In the 66 cases in which notes of previous pregnancies are available, there is a total of 283 children and 43 miscarriages. This is an average fertility of 4·3 children and 0·7 miscarriages.

Symptomatology.

The presenting symptom was :—

Abnormal uterine hæmorrhage	.. .. ..	in 59 cases
Vomiting	.. .. ..	in 4 ,,
Abdominal pain ..	.. .. ..	in 3 ,,
Swelling of feet ; headaches	.. .. ..	in 2 ,,
Abdominal enlargement ..	.. .. ..	in 1 case
No note	.. .. ..	in 3 cases

72 cases

Duration of amenorrhœa before the onset of bleeding.

Bleeding one month or less after last menstrual period ..	7 (10%)
Amenorrhœa one to three months	42 (60%)
Amenorrhœa three to nine months	11
Amenorrhœa one year or more	2
Unrecorded	10

72

Size of uterus in comparison with apparent duration of pregnancy.

Part or whole of mole passed before admission ..	20 cases
Unrecorded	15 ,,

35 cases

Therefore, in the 37 cases in which the duration of pregnancy and the size of the uterus before any mole was expelled are recorded :—

In 24 cases the uterus was bigger than one would have expected	64·8%
In 5 cases it was correct in size	13·6%
In 8 cases it was smaller than one would have expected ..	21·6%

Briggs and Essen-Moller have observed, in many cases, the uterus to be smaller than the normal for the duration of pregnancy.

Albuminuria.

No albumin	25
Albumin up to heavy cloud on boiling	7
Large amounts of albumin	5
Unrecorded	35

72

Therefore albumin in urine in 12 cases out of 34 examined = 35%.
Also No. 26, pus ; No. 34, culture, *Bacillus coli communis.* No. 71, culture, streptococci

The large number of cases in which urine was not recorded as having been examined is presumably due to the impossibility of obtaining a specimen for examination without the passage of a catheter, as the majority of patients were actually bleeding vaginally on admission.

Differential diagnosis.

The original diagnosis was :—

Some type of abortion	in 36 cases
Placenta prævia	in 2 ,,
Menorrhagia (1 case) P.M.H. (1 case)	in 2 ,,
i.e. abnormal uterine hæmorrhage in 40 cases.	
Fibroids	in 6 ,,
Fibroids and normal pregnancy	in 1 case
Ovarian cyst	in 1 ,,
Ovarian cyst and normal pregnancy	in 1 ,,
i.e. pelvic tumour in 9 cases.	
Neurotic vomiting	in 2 cases
Correctly diagnosed before vesicles escaped ..	in 4 ,,
Normal pregnancy and chronic nephritis	in 1 case

<div align="right">

56 cases
</div>

In the remaining 16 cases the diagnosis was certain, as typical hydatidiform mole had escaped or was escaping on admission.

Much the commonest error in diagnosis was that of ovarian or uterine tumour (8 cases). Most of these errors occurred in the patients over 40 years of age in whom short periods of amenorrhœa and irregular uterine hæmorrhage were liable to be regarded as menopausal symptoms. In one other case the original diagnosis of ovarian cyst and normal pregnancy was correct, in so far as there were bilateral large multilocular lutein cystomata of the ovaries plus a uterus enlarged by the presence of hydatidiform mole.

(In Findley's 500 cases from the literature $11 \cdot 6\%$ had cystic ovaries.)

Treatment.

General anæsthetic, manual expression, digital separation, removal with ovum forceps	27 cases
Majority of mole spontaneously expelled; remaining fragments digitally removed because of persistent bleeding	13 ,,
Spontaneous expulsion complete; operative assistance unnecessary	9 ,,
Surgical induction of abortion of mole with laminaria tents and gauze packing	8 ,,
Surgical induction with small rubber bag	1 case
Surgical induction by vaginal hysterotomy	1 ,,
Dilatation and curettage. (Mole expelled usually some weeks previously)	5 cases
Sub-total hysterectomy	4 ,,
Pan-hysterectomy	2 ,,
Laparotomy, bilateral ovariotomy, and subsequent spontaneous abortion of the mole per vaginam	1 case
Death of patient from hæmorrhage, mole still *in utero* ..	1 ,,

<div align="right">

72 cases
</div>

Primary mortality P.M. 375/1922.—In this series of 72 cases there has been only one death directly attributable to the mole pregnancy. This was case 43, a woman 36 years of age who had had three children. Her last normal period was three months before admission and she complained of slight daily vaginal bleeding for eight weeks and severe bleeding for twenty-four hours; the history being that the blood had soaked through two mattresses. She was moribund from anæmia on admission. Intravenous saline was given at once, but she died before a blood transfusion could be carried out. The uterus reached 2 in. above the umbilicus and there was about half-a-pint of bleeding in hospital before the cervix could be plugged. The post-mortem examination showed acute anæmia of all organs, and in the uterus a large benign hydatidiform mole.

The hydatidiform mole mortality as published shows considerable variation.
Findley: 265 benign hydatidiform moles. 28 died = 10·5%.
Gordon: Mortality 9%. De Lee: 16%.
Sande: 5% of 122 cases of hydatidiform mole died.
Dorland: 100 cases of hydatidiform mole % from literature; 10% mortality. 3% hæmorrhage at time of operation; 2% perforation of uterus; 5% infection.
The low mortality rate in the present series—1·4%—may be fortuitous in so far as the series consists of relatively few cases but is largely the result of the methods of treatment adopted.

Convalescence.

Pyrexia: In six cases the temperature charts are not available. Those of the remaining 66 cases may be divided into the following groups:—

Afebrile	24
Febrile to a degree not above that of minimum puerperal morbidity	17
Moderate pyrexia lasting up to 14 days	19
Pyæmia	2 } 9%
Septicæmia	4 }
	—
	66

Case 25.—Digital evacuation of mole from uterus: Pyrexia 99-104, settled fourth week. Blood-culture sterile, third week. Abscess in back, pus grew streptococci. Swelling of left shoulder and first metacarpophalangeal joint, subsided spontaneously.

Case 34.—Digital evacuation of mole from uterus: Pyrexia seven weeks. Blood-culture twice sterile; deep abscesses right and left thighs, pus grew streptococci.

Case 45.—Spontaneous evacuation of mole: Remittent and intermittent pyrexia up to 101° *nocte* for ten weeks. Blood-culture twice sterile; subinvoluted uterus. Discharged herself, still febrile.

Case 52.—Exploration of uterus: Four rigors in fourteen days after exploration of uterus. Blood-culture sterile; then pan-hysterectomy for chorion-carcinoma.

Case 54.—Digital exploration of uterus; uterus packed sterile gauze: Twenty-three rigors in four weeks; blood-culture twice sterile. Temperature settled seventh week.

Case 59.—Vagina packed before mole was expelled spontaneously: Pyrexia up to 102·5 for four weeks; then second post-partum hæmorrhage; chorion-carcinoma. Pan-hysterectomy.

Two of the cases complicated by puerperal septicæmia developed chorion-epithelioma.

Secondary Hæmorrhage.

Six patients were treated primarily by hysterectomy; none of these developed post-operative hæmorrhage, as a complication, and in one other case the patient died before the mole was expelled.

Of the 65 remaining cases ten developed abnormal uterine hæmorrhage within a few weeks of the expulsion of the mole, i.e. 15%. In each case the uterus was explored, or re-explored, and fragments of tissue were sent for histological examination.

In six cases (27, 40, 50, 52, 59 and 64) the histological report was chorion-epithelioma and pan-hysterectomy was performed. In four of these cases (27, 50, 52, 59) subsequent examination of the uterus confirmed the diagnosis of chorion-epithelioma.

Complete investigation of these ten cases resulted in the following findings and treatment :—

Treated by curettage followed by pan-hysterectomy	Chorion-epithelioma	in 4 cases
	Retained tissue histologically suggestive of chorion-epithelioma	in 2 „
Treated by curettage only	Retained fragments of benign mole	in 2 „
	Functional abnormal uterine hæmorrhage not associated with retained mole or developing chorion-epithelioma	in 2 „

                                                        10 cases

Case 27.—Aged 31 years; married two years; no previous pregnancies. Five months before admission, when four and a half months pregnant, spontaneously expelled a hydatidiform mole. For six weeks before admission had continuous slight brown vaginal discharge, also occasional short brisk hæmorrhages. Exploration of the uterus revealed some enlargement of the left cornu. Curettage was performed and the tissues removed were sent for histological examination. The report was blood-clot, fibrin, and a few masses of atypical luxuriant chorionic epithelium.

In view of these findings, five months after the spontaneous evacuation of the mole a pan-hysterectomy was performed by Mr. Gordon Luker. The uterus after removal showed two small areas of infiltrating chorion-epithelioma in the fundus of the uterus. Histological examination confirmed this diagnosis. A section of one ovary showed abnormal excessive lutein tissue formation in the right ovary, which was not abnormally large.

Follow-up.—This patient was alive and well thirteen years later.

Case 50.—Aged 44 years; seven children, last nearly four years ago; no miscarriages. Last menstrual period five months ago. Six weeks before admission continuous vaginal bleeding for seven days, and since then for three or four hours every three or four days.

On examination: Large uterus reaching above umbilicus. Spontaneously aborted mole immediately after admission.

Histological report.—Hydatidiform mole. Chorionic epithelium very luxuriant in connexion with many villi.

Twelve days later, still red lochia. Uterus explored. A little irregularity on right side of fundus felt, but no definite retained fragments of mole found. Patient transferred to a convalescent home, but twenty-nine days after mole delivered, she had a very sudden profuse vaginal hæmorrhage whilst walking in the grounds. She was returned to bed almost pulseless and when fit was transferred back to hospital. Thirty-three days after the expulsion of the mole, i.e. four days after the severe secondary hæmorrhages, Mr. Eardley Holland performed an abdominal pan-hysterectomy. The uterus has been lost, but it is recorded that a small

area of typical chorion-epitheliomatous growth was found in the right cornu. A microscopic section through this region showed chorion-epithelioma invading the wall of the uterus.

Follow-up.—This patient was alive and well, with no clinical evidence of recurrence eight years later.

Case 52.—Aged 30 years; one child four years ago; one miscarriage at three months four weeks ago. Her doctor estimated the miscarriage at about four months, but no fœtus was seen; red loss ceased after fourteen days. After twelve days without any bleeding, daily hæmorrhages recurred for eight days before admission. She was admitted for exploration of the uterus under the diagnosis of incomplete abortion. A sound was passed 5 inches and an unusual mass was found in the wall of the fundus uteri; some vesicles were removed when the uterus was explored with ovum forceps. The tissue removed was examined histologically and proved to be portions of the myometrium infiltrated by malignant hydatidiform mole (chorion-epithelioma).

Fifteen days later Dr. Russell Andrews performed a pan-hysterectomy. At the operation a secondary deposit was felt in the wall of the vagina, but was not removed.

The uterus showed a typical chorion-epitheliomatous growth in the posterior wall of the upper part of the uterus, confirmed by histological examination.

Follow-up.—This patient was alive and well nine years later.

Case 59.—Aged 49 years; four children, the last four years ago; two miscarriages, the last nine years ago. For eight months periods irregular; longest period of amenorrhœa two months. Sent up as an obstetric emergency under the diagnosis of placenta prævia.

On admission: Very anæmic; still bleeding. Fundus uteri, twenty-eight weeks. No fœtus palpable or audible; cloud of albumin in urine on boiling; blood-pressure 180/90. Cervix dilated one-fifth. A few vesicles removed digitally. Spontaneous expulsion of mole the day after admission, the cervix and vagina having been packed with flavine gauze. Subsequently intermittent pyrexia up to 102·5°. Lochia ceased normally, but thirty-two days after expulsion of mole sudden secondary hæmorrhage of about half a pint.

Forty-one days after expulsion of mole, uterus explored with a blunt curette. Tissue removed from a soft area on left side of region of internal os. This showed a number of fragments of myometrium and hypertrophied endometrium, some invaded by chorion-epithelioma. Fifty-seven days after expulsion of mole, pan-hysterectomy was performed by Mr. Victor Lack.

The uterus showed two focal areas where the myometrium was invaded by chorion-epithelioma. The slide taken from the larger growth at the left of the internal os confirms the diagnosis of chorion-epithelioma.

Follow-up.—This patient was alive and well more than five years later.

In the other two cases (40, 64) in which the report on the curettage after secondary hæmorrhage was chorion-epithelioma, pan-hysterectomy was performed, but no growth was found in either uterus.

(Whitridge Williams states that a permanent cure may occasionally follow a simple curettage.)

Case 40.—Aged 47 years; ten children. Three months' amenorrhœa, followed by the abortion of a hydatidiform mole. Admitted to hospital; uterus cleared digitally. Readmitted six weeks' later, as two floodings had occurred; the second, on the day of readmission being very severe—(alleged several pints). Curettage was performed by Mr. Victor Lack. Sound passed 2½ inches; several vesicles and much blood-clot removed. The histological report was chorion-epithelioma. As a result, pan-hysterectomy was performed (Gordon Luker). Macroscopically a small flat growth, of the size of a florin in diameter, appeared to be present high up on the posterior wall of the uterine cavity. Histologically there was no evidence of any chorion-epithelioma in this or in other parts of the uterus. Theca lutein cysts were present in both ovaries.

Follow-up.—This patient was alive and well ten years later.

Case 64.—Aged 50 years ; six children. Last menstrual period seven months ago. Two months ago, blood-stained discharge for two days. Admitted as an emergency with severe vaginal bleeding for several hours. Uterus just above umbilicus. Spontaneous abortion of a large hydatidiform mole. Six weeks later readmitted for curettage. A little blood-stained discharge on two occasions three weeks after leaving hospital ; nil since. Curettage was reported as chorion-epithelioma, and three weeks later a pan-hysterectomy was performed by Mr. Eardley Holland. There was no macroscopic or microscopic evidence on examination of the uterus of chorion-epithelioma.

Follow-up.—This patient remains alive and well four years later.

In two cases (31, 41) the histological report was retained fragments of benign mole. Both have been followed up and they were alive and well thirteen and eleven years later respectively. In two cases (47, 72) the histological report was fragments of endometrium only. The second patient had, in addition, a negative Zondek-Aschheim reaction. Both patients remain well, respectively nine years and six months later. (The Friedmann test in the latter case was also negative.)

In 20 other cases in which there had been no excessive or abnormal uterine hæmorrhage or discharge a prophylactic exploration of the uterus and curettage was carried out six to twelve weeks later in order that chorion-epithelioma, if present, might be diagnosed as early as possible. In no case was there any macroscopic or microscopic evidence of chorion-epithelioma and in no case is chorion-epithelioma known to have developed at a later date.

Incidence of Chorion-epithelioma following Hydatidiform Molar Pregnancy

In addition to the four cases described under secondary hæmorrhage, there were two other definite cases that developed chorion-epithelioma :—

Case 49.—Aged 45 years ; four children, last nineteen years ago. Last menstrual period eleven weeks ago. Five weeks and three and a half weeks ago slight vaginal bleeding for a few hours. Two days' severe bleeding and vomiting. Anæsthetic ; placental remains digitally removed ; cavity swabbed out with iodine and packed with gauze. Discharged after one week in hospital. Readmitted ten weeks later. Slight irregular periods since last admission. Seven weeks' dull, aching pain in lower abdomen. Twenty-four hours before admission, began to bleed from vagina. Sixteen hours before admission, onset of severe abdominal pain, vomiting, and difficulty in micturition. *On admission* : Ill ; anæmic ; chest clear ; general abdominal tenderness and rigidity with indefinite lump in left lower quadrant. Lump the size of a tangerine orange in the pouch of Douglas. Emergency laparotomy (performed by Mr. Gordon Luker.) Much free blood in the abdomen, in which was found a mass of hydatidiform mole lying free. A hole was found below and behind the right cornu of the uterus through which more mole could be seen. Pan-hysterectomy was performed.

Follow-up.—This patient was alive and well eight years later. A microscopic section through the edge of this perforation shows hydatidiform villi covered by excessive infiltrating trophoblast (chorion-epithelioma).

Case 3.—Aged 31 years ; single. Four months' amenorrhœa, followed by bleeding and the spontaneous abortion of a hydatidiform mole, ten days before admission. Admitted because of slight continuous vaginal bleeding since then. The mole was sent for examination and shows the features of a benign hydatidiform mole.

The uterus reached nearly up to the umbilicus, but on exploration contained nothing but blood-clot and a little débris. She was readmitted six weeks later for diagnostic curettage, in case an early chorion-epithelioma should be present. (There had been no bleeding or discharge.) Histologically this curettage revealed nothing more than normal endometrium and menstrual débris. Twenty-four weeks after the spontaneous abortion of the mole, there was an onset of constant pain, low down in the back and worse at night. Patient was no

better after complete rest in bed for one month. Bowels open only once every two or three days since the mole was aborted, but on readmission thirty weeks later the patient complained of rectal incontinence. There was a pleural effusion over the right lower lobe of the lungs and the aspirated fluid was blood-stained and contained polymorphonuclear leucocytes and endothelial cells. The temperature was intermittent during nearly two months that she was in hospital, 98°—102°. Nine months after the mole was expelled the patient suddenly became unconscious and died half an hour later.

A post-mortem examination revealed: (1) In the uterus and vagina, no macroscopic or microscopic evidence of hydatidiform mole or chorion-epithelium; (2) primary chorion-epithelioma of the rectovaginal septum and presacral tissues; (3) disseminated secondary growths of chorion-epithelioma in many organs, especially lungs and liver.

Spontaneous perforation of a subarachnoid vein by a malignant deposit caused a fatal subdural hæmorrhage.

One other case (24) should be mentioned :—

Patient, aged 36 years; two children, aged 13 years and 8 years respectively.

Six weeks before admission, three months' miscarriage. Since then uterus explored and cleared out three times because of repeated hæmorrhages. On admission uterus explored a fourth time. The histological report on this curettage was dropsical villi covered with excessive chorion-epithelium and numerous giant cells in the decidua. No definite evidence of chorion-epithelioma, but appearances suggestive of malignancy well marked.

Pan-hysterectomy performed by Mr. Gordon Luker; large irregular greenish-white ulcer found in the endometrium.

Three sections from the wall of the uterus show doubtful chorion-epithelioma and very atypical decidual hyperplasia.

Follow-up.—This patient could not be traced. The pathological condition is one to which the old name for chorion-epithelioma " deciduoma malignum " might reasonably be applied.

SUMMARY OF THE INCIDENCE OF CHORION-EPITHELIOMA IN THIS SERIES OF 72 CONSECUTIVE CASES OF HYDATIDIFORM MOLE

Primary mortality from hæmorrhage			1 case
Primary hysterectomy. { Pan-hysterectomy ... 2 } { Sub-total hysterectomy ... 4 }		...	6 cases
Untraced		...	17 ,,
Traced—no evidence of chorion-epithelioma			39 ,,
Death from disseminated chorion-epithelioma eight months after abortion of hydatidiform mole (uterus—not removed)			1 case
Secondary pan-hysterectomy of chorion-epithelioma. Definite growth in uterus removed			5 cases
Secondary pan-hysterectomy for malignant hydatidiform mole. Doubtful evidence of chorion-epithelioma in uterus			1 case
Secondary pan-hysterectomy for chorion-epithelioma. No growth in uterus removed			2 cases
			72 cases

(Incidence of chorion-epithelioma, 6 cases = 8·3%.)

The relationship between hydatidiform mole and chorion-epithelioma has been frequently referred to in the literature.

Findley, 500 cases; 157 developed chorion-epithelioma (31·4%).

Pallosson and Violet, 455 cases; 203 chorion-epithelioma (44%).

Novak, only 1% of hydatidiform moles became chorion-epithelioma.

Senarcleus, 49 hydatidiform moles. 13% became chorion-epithelioma.

Many of these figures are not comparable with the incidence of 8·3% in the present series, because they are derived from an analysis of collections of individual cases, or small groups of published cases, and not from a consecutive series from one large hospital.

Conservative treatment of hydatidiform mole.—In the 40 traced cases in which the uterus was not removed, either primarily or secondarily, the conservative treatment adopted must be justified or condemned on the following findings :—

One patient died eight months later from disseminated chorion-epithelioma, the primary growth being in the cellular tissues around the rectum, and not in the uterus.

Thirty-nine patients subsequently developed no evidence of chorion-epithelioma. Many of them were of early child-bearing age at the time of the molar pregnancy, and 17 who subsequently became pregnant had among them 37 children and 11 miscarriages. No evidence was obtained to suggest that any of the miscarriages were hydatidiform moles.

Pregnancy tests : their value in diagnosis, prognosis, and treatment.—The pregnancy tests are now available as an additional method of assisting prognosis. It is only in the last two cases of this series that the Zondek-Aschheim and Friedman tests of pregnancy have been employed.

Case 71.—The pregnancy test findings in this case are of considerable interest, especially in their interpretation in relation to prognosis and treatment.

The patient, aged 21 years, had been married eighteen months, and this was her first pregnancy. Her last period was fourteen weeks before admission.

Her symptoms on admission may be summarized as follows : Six weeks' morning vomiting: two weeks, vomiting everything. Four weeks before admission, brown discharge for three days : three weeks before admission, slight bleeding for one day ; one week before admission, bleeding like a menstrual period.

Loss of weight about 1 st.

Physical signs on admission : Pale ; very thin : breasts active ; nothing abnormal discovered on clinical examination of the chest.

Uterus enlarged to size of twenty-four weeks' pregnancy. (Last menstrual period fourteen weeks ago.)

Fœtus not felt ; fœtal heart not heard.

Trace of albumin in urine. Blood-pressure 135/75.

Blood-count : Secondary anæmia. R.B.C. 3,700,000 ; C.I. 0·9 ; W.B.C. 6,800 ; 74% polymorphonuclear leucocytes.

Sputum : No tubercle bacilli or chorionic tissues.

X-ray examination : Chest clear. No fœtus visible in abdomen or pelvis.

Pregnancy tests : Day of admission, Zondek-Aschheim, strongly positive. (0·4 c.c. injected twice on first day, three times on second day, and once on third day ; mice killed after 100 hours. Total urine detoxicated with ether 2·4 c.c.)

Seven days after admission, Friedman test positive ; quantitative Zondek-Aschheim positive in dilutions of 1 : 25, 1 : 100, 1 : 200.

Fourteen days after admission, uterus explored. Hydatidiform mole vesicles found. Four laminaria tents inserted in cervix ; vagina packed.

Next day, after the injection of 5 units of pituitrin twice in an interval of two hours, strong uterine contractions began. Mole digitally evacuated and bimanually expressed from uterus under anæsthetic. Considerable bleeding, controlled by hot douche, pituitrin and ergotoxin. As a result the blood-count dropped from 3,400,000 red cells with colour-index 0·9 to 2,400,000 with colour-index 0·7.

Histological report : Hydatidiform mole ; no definite evidence of malignancy.

Seven weeks after evacuation of the mole the patient was discharged from hospital. The clinical findings at that time were : General condition much improved ; no vomiting ; gain in weight ½ st.; urine clear ; blood-pressure 125/80. Cough less ; no sputum. No vaginal bleeding or discharge. Uterus involuting well ; still a little bulky.

Blood-count : R.B.C. 4,000,000 ; C.I. 0·86.

Pregnancy tests : Friedman, positive. (10 c.c. of ether-detoxicated urine injected twice with an interval of twenty-four hours, intravenously. Rabbit killed after fifty hours.)

Quantitative Zondek-Aschheim : Undiluted urine, positive. Urine diluted 1/25, negative ; 1/100, negative ; 1/200, negative.

The patient was watched, as carefully as she would allow, in the gynæcological follow-through department with the following results :—

Fourteen weeks after evacuation of the mole: General condition improving ; still gaining weight ; good colour. Still occasional cough ; sputum sometimes blood-stained ; five weeks' slight daily vaginal bleeding.

Pregnancy tests : Friedman, positive. Quantitative Zondek-Aschheim, undiluted positive ; diluted 1/25 ; 1/100 ; 1/200, negative.

Because of these findings she was admitted at once for a diagnostic curettage. Histological report: Fragments of necrosed tissue and blood-clot from the uterus. No recognizable tissue except a small fragment of inflamed endometrium ; a few scattered large cells and one structure like the skeleton of a necrosed vesicular chorionic villus.

Eighteen weeks after the evacuation of the mole and four weeks after the diagnostic curettage her general condition was still excellent; there was no cough, and all vaginal bleeding and discharge had ceased a few days after the curettage. The uterus was well involuted, mobile, and anteverted.

Pregnancy test : Friedman, positive.

Twenty-two weeks after the evacuation of the mole no alteration in symptoms and physical signs since last examination.

Pregnancy tests : Friedman, positive. Quantitative Zondek-Aschheim, undiluted, positive ; diluted 1/25, 1/100 negative.

Thirty-nine weeks (nine months after evacuation of the mole) : General condition of the patient excellent, no symptoms : perfectly normal regular menstrual periods since last visit (four in all). No abnormal physical signs.

Pregnancy test : Friedman, negative.

Table I summarizes the pregnancy test findings in this case.

TABLE I.—PREGNANCY TEST FINDINGS IN CASE 71

Time when pregnancy tests were made	Friedman	Zondek-Aschheim		
	1/1	1/25	1/100	1/200
2 weeks before evacuation of mole...	++			
1 week before evacuation of mole ...	+	−	−	−
7 weeks after evacuation of mole ...	−	−	−	−
14 weeks after evacuation of mole ...	−	−	−	−

Curettage

18 weeks after evacuation of mole ...	−			
22 weeks after evacuation of mole ...	−	−	−	−

Menstruation recommenced

39 weeks after evacuation of mole ...	−	−	−	−

It is of interest to recall here that :—

(1) Schmorl, 1904, found chorionic cells in 80% of 158 women dying at different stages of normal pregnancy.

(2) A fatal case of hydatidiform mole with multiple small syncytial infarcts of the lungs was recorded by J. E. Hughes (*Proc. Roy. Soc. Med.*, 1930, xxiii, 33-35).

(3) Professor James Miller at a meeting of the Edinburgh Obstetric Society recorded a fatal case of hydatidiform mole, in which entire chorionic villi were recognized in the lungs.

(4) T. G. Stevens (*Clin. Journ.*, 1927, lvi, 133-36) recorded a case of hydatidiform mole with multiple lung trophoblastic metastases and death from hæmoptysis after intravenous saline.

In case 72 the pregnancy tests proved of clinical value.

The patient, aged 51 years, had had seven children. Her menstrual periods were quite regular and normal including the last ten weeks before admission. Her symptoms on admission were: Four weeks' nausea, no vomiting; ten days' slight vaginal bleeding; three days' bleeding more severe; part of hydatidiform mole spontaneously aborted during the few hours preceding her admission.

Pregnancy tests on day after admission. Quantitative Zondek-Aschheim: Urine undiluted, positive in three out of four ovaries: diluted 1/25, 1/100 and 1/200 negative.

Two days after the urine was taken for the above tests Mr. Eardley Holland explored the uterus. The uterine sound passed four inches, a blunt curette removing no tissue resembling the hydatidiform mole.

Four weeks after evacuation of the mole the patient remained well. Flooding—much more than a normal period one week before—now ceased.

Pregnancy tests: Quantitative Zondek-Aschheim: Undiluted, negative; diluted, 1/25, 1/100 and 1/200, negative.

Patient readmitted. Uterus explored; strips of rather thick endometrium removed by sharp curette. No evidence of chorion-epithelioma.

In view of these findings, and of her age (51 years), a menopausal dose of radium (80 mgm. for twenty-two hours) was inserted in the uterus. Histological report on this curettage: Hæmorrhage into fragments of hyperplastic endometrium.

Thirty-nine weeks after the evacuation of the mole: Patient very well; good colour; gaining weight; complete amenorrhœa since curettage and radium treatment.

Pregnancy test: Friedman, negative.

Table II summarizes the pregnancy tests findings in this case.

TABLE II.—PREGNANCY TESTS FINDINGS IN CASE 72

Time when pregnancy tests were made	Friedman	Results Zondek-Aschheim		
	1/1	1/25	1/100	1/200
Day after spontaneous evacuation of mole	+	–	–	–
Blunt curettage				
4 weeks after the evacuation of the mole	–	–	–	–
Sharp curettage and menopause dose of radium				
39 weeks after the evacuation of the mole	–			

Additional case of hydatidiform mole. (Case 73.)

I. A., aged 26. Two children, the second over four years ago. Both labours normal. No miscarriages. Last menstrual period, August 16, 1934. First attended ante-natal out-patients February 19, 1935 (that is after six months' amenorrhœa). Small show when periods expected during first three months of this time; then amenorrhœa until one week before admission. Severe bleeding at night and slight bleeding each day since then. No fœtal movements felt by patient. Urine clear. Fundus uteri twenty weeks. No fœtus felt. Cervix closed. Nothing abnormal felt in pelvis. X-ray examination: No evidence of fœtus. Friedman test positive. Quantitative Zondek-Aschheim: Positive, undiluted 1/25, 1/100, 1/200. February 26, admitted to London Hospital. Fundus uteri 2 inches above umbilicus. No clinical signs of fœtus. Quantitative Zondek-Aschheim: Positive, 1/200, 1/400, 1/800. February 28, two laminaria tents in cervix; vagina packed. March 1, small glycerine pig's bladder in uterus. March 2, bladder and mass of mole spontaneously expelled. Catheter specimen of urine, cloud of albumin, acid. Culture: *Staphylococcus albus*; many red cells and excess of leucocytes; epithelial cells. March 3, more mole expelled. March 4, Friedman test positive.

CHORION-EPITHELIOMA

Since 1912, 16 cases of chorion-epithelioma have been admitted to the London Hospital, and they have been classified into the following groups.

Cases of Chorion-epithelioma admitted to the London Hospital since 1912.

Following a hydatidiform mole pregnancy	6 cases.
Following an abortion	3 ,,
Following full-time normal pregnancy and labour ..	3 ,,
Occurring in males	2 ,,
No primary in genital tract	1 case.
Notes missing	1 ,,

16 cases.

The 6 cases of chorion-epithelioma following hydatidiform mole pregnancies have already been considered.

In 3 cases (7, 8, 9) the chorion-epithelioma developed after a recent abortion, the exact nature of which was unknown. The abortion in each case may have been a hydatidiform mole, but there is no macroscopic or microscopic evidence or definite clinical history to establish the facts.

Case 7.—Patient, aged 19 years. Four months' miscarriage eleven months before admission. Baby present and two weeks later (during which time there was continuous bleeding) patient passed a large lump from the vagina like a " bunch of grapes." One month later curetted because of bleeding and floodings. Nine months after the miscarriage again curetted at a different hospital. Chorion-epithelioma was diagnosed and a subtotal hysterectomy, with removal of all appendages, was performed. Eleven months after the miscarriage and fourteen days before her death she was admitted to the London Hospital very ill; bleeding from the vagina. Normal cervix felt; bimanual examination impossible ; very anæmic ; progressive deterioration in vision ; unconscious twenty-four hours before death.

Post-mortem examination revealed : Chorion-epithelioma of cervix ; cerebral softening from obstruction of left middle cerebral artery by a malignant growth embolus ; multiple secondary deposits in lungs, spleen, jejunum, &c.

Case 8.—Patient, aged 26 years ; one child. Three months before admission, miscarriage at three months. Last menstrual period one month later—that is, two months before admission. No vaginal bleeding or discharge since then. For several weeks, repeated attacks of slight hæmoptysis, coughing up small clots of blood. Four hours before admission, awakened by severe lower abdominal pain. Vomited once ; no vaginal bleeding. After admission : evidence of progressive intraperitoneal hæmorrhage. Cystic swelling in pelvis not altered by catheterization. Laparotomy revealed a large quantity of free blood in peritoneal cavity. Ragged hole in anterior wall of pouch of Douglas, through which grape-like structures were protruding. Cavity packed with flavine gauze ; abdomen closed. Patient died before a blood transfusion could be given.

Post-mortem report: Hæmoperitoneum. Chorion-epithelioma in floor of pouch of Douglas. No growth in uterus, Fallopian tubes, or ovaries. Small secondary nodule in anterior wall of vagina close to outlet. Small secondary nodules in lungs, with attempt at villus formation.

Case 9.—This is the only case of chorion-epithelioma not definitely preceded by hydatidiform mole, in which the pregnancy test was employed as an aid to diagnosis.

Patient, aged 26 years. Two children, the second three and a half years ago. Twelve months before admission two months' miscarriage, followed by irregular bleeding for one month. Then, after two months' amenorrhœa, irregular uterine bleeding began, necessitating curettage on two occasions. Six weeks before admission, sudden onset of severe convulsions when out walking ; chloroform used to control them. Jacksonian epilepsy, worse on right side ; diplopia followed for several hours. Since then almost incessant headaches, and for three days, nausea and vomiting.

On examination.—Thin, healthy-looking. Wassermann reaction negative. Slight nystagmus, right greater than left; no papilloedema; intention tremor—right hand. Cerebrospinal fluid normal. Signs of increasing intracranial pressure developed.

Seen by Mr. Eardley Holland at the request of Mr. Hugh Cairns. Mr. Holland made the following note: "Uterus enlarged to size of eight weeks' pregnancy and soft swelling in region of right ovary, probably ovarian, size of a golf ball. It is possible that the patient has a chorion-epithelioma of the uterus with a secondary intracranial deposit. In this case swelling of the right ovary would be a compound lutein cystoma. A Zondek-Aschheim test should be done to see if an excess of the anterior pituitary-like hormone is present. A positive result would confirm the diagnosis of chorion-epithelioma."

Urine was sent the next day to the Pregnancy Diagnosis Station, Edinburgh, and the following report on it was received: "We have examined the specimen of urine and have found that the concentration of gonadotrophic hormone is very high, dilutions of 1 in 200, giving positive reactions when the normal doses are employed. This result supports your diagnosis of chorion-epithelioma."

Fourteen days later a pan-hysterectomy was performed by Mr. Holland because of the records published from time to time of the spontaneous disappearance of secondary chorion-epithelioma deposits on the removal or destruction of the primary growth. No such good fortune attended this patient, and in spite of post-operative treatment with lead selenate she died in coma about three weeks later. A post-mortem confirmed the diagnosis. Multiple deposits of chorion-epithelioma in the lungs, a small secondary deposit of chorion-epithelioma in the myocardium of the left ventricle, and a large secondary deposit of chorion-epithelioma in the brain were found.

Chorion-epithelioma following full-time normal pregnancy and labour. The three cases in this series all ended fatally.

Case 10.—Patient, aged 32; second child born seven and a half months before admission. No miscarriages. Continuous blood-stained vaginal discharge since the labour. Fourteen days' pain in the back on walking. Stony hard, fixed mass, about the size of a cricket ball, fixed low down on the right side of the pelvis. Laparotomy (H.R.A.) under the diagnosis of pyosalpinx. Chorion-epithelioma found, perforating the uterus and adherent to the right pelvic wall. Profuse hæmorrhage when fundus was lifted up. Subtotal hysterectomy. Patient died half an hour after operation, apparently from internal hæmorrhage. No post-mortem examination. Uterus not available.

Histological report.—Chorion-epithelioma involving endometrium and serosa of body and external os of cervix uteri.

Case 11.—Single woman; five months before admission had had a stillborn child. No miscarriages. Blood-stained vaginal discharge since birth of child. Necrotic mass, size of a large mushroom, attached by a fleshy pedicle to the back of a moderate cystocele. Cervix normal. (? Sloughing vaginal fibroid dissected away as in anterior colporrhaphy).

Histological report.—Chorion-epithelioma malignum in vagina.

Readmitted three and a half months later with vesico-vaginal fistula. Growth palpable in posterior wall of uterus. Vaginal hysterectomy. Subsequently mass developed in right iliac fossa. Histological report on uterus: Chorion-epithelioma of body of uterus. Patient developed progressive cachexia and died eleven months after labour, and six months after first operation. At post-mortem examination secondary deposits of growth were found in both lungs, in addition to growth in pelvis adjacent to hysterectomy scar.

Case 12.—Patient, aged 29. No miscarriages. Third labour six weeks before admission. Since then recurrent attacks of uterine hæmorrhage. Uterus explored twice, the second time four days before admission. Very anæmic. Third curettage was one month after admission: much débris removed—? placenta.

Histological report.—Fragments of chorion-epithelioma from body of uterus.

One week later pan-hysterectomy with removal of all appendages (H.R.A.). After removal of uterus nodule of growth seen on anterior wall of rectum. After operation patient had intermittent pyrexia and two rigors. She died five weeks later—that is, nearly four months after her last labour.

Post-mortem examination revealed acute fibrino-purulent endocarditis, pyæmia, purulent pelvic cellulitis, chorion-carcinoma of upper edges of vaginal stump, secondary deposits of growth in lungs and one femur.

Chorion-epithelioma in males.

Case 13.—Patient, aged 24. Swelling of right testis since an injury three months before admission. Two weeks—nausea, vomiting, loss of appetite, headaches, vertigo and diplopia.

On examination.—Pale, ill man, with a solid tumour of right testis, size of a fist; no thickening of cord; upper motor neurone paresis of left side of face. Death.

X-ray examination.—Shadows of secondary deposits in left lung.

A post-mortem examination revealed a teratoma, 9 × 7 × 9·5 cm., replacing the right testis. Microscopically, areas in this tumour showed the typical appearance of chorion-epithelioma. There were multiple secondary deposits of chorion-epithelioma in the lungs and a single large similar deposit in the cerebellum.

Case 14.—Patient, a man, aged 23, had complained for six months of increasing pain in the back, recently spreading into the legs. Marked cachexia and loss of weight. Intermittent pyrexia up to 102° F. Many lumps palpable in the abdomen. Clinical diagnosis—retroperitoneal sarcoma. Death from cachexia.

Post-mortem report.—Very small teratoma in the centre of the right testis and multiple secondary deposits of chorion-epithelioma in the liver and in the lungs.

In the two remaining cases the case-records make no mention of previous pregnancies or of menstruation.

Case 15.—Patient, aged 49, admitted into a surgical ward with the following history :—

One month ago, severe attack of pain in right hypochondrium radiating into right shoulder and arm, lasting a week. Progressive loss of weight. Recurrence of pain with vomiting four days ago. Rigidity and tenderness in right hypochondrium led to an exploratory laparotomy. Large cystic swelling found in liver. Aspiration yielded pure blood; much blood-stained fluid in peritoneal cavity. Growth palpable in other viscera and in pouch of Douglas. Abdomen closed. Four days later, normal period occurred, and seven weeks later patient died.

Post-mortem examination revealed multiple secondary deposits of chorion-epithelioma in the liver and other organs. No definite primary focus could be identified in the genital tract or elsewhere.

Case 16.—Patient, aged 30. No notes available. Diagnosis—pneumonia. Died day of admission after laparotomy.

Post-mortem findings.—Anæmia from hæmorrhagie; hæmoperitoneum (1½ pints).

Perforation by chorion-epithelioma of a uterus greatly enlarged by masses of growth in its right wall (14·5 × 10 × 6·5 cm.).

Three perforations of growth into the peritoneal cavity and one into right vaginal fornix. Secondary deposits of growth in both lungs. Direct invasion by growth of right ovary and trigone of bladder.

SUMMARY

One case of combined normal gestation and a molar gestation suggests that the ætiological factor is probably an inherent abnormality of the ovum and not of the mother.

Molar gestations occur at all child-bearing ages, but in this series 37·5% occurred in women 40 years of age or more.

The average previous fertility is 4·3 children and 0·7 miscarriages, but 23·6% were primigravida.

In about 20% of cases the uterus is smaller than the calculated duration of pregnancy would lead one to expect.

In 35% of 34 cases where the examination was recorded in catheter specimens there was albuminuria.

The commonest error in diagnosis was pelvic tumour (uterine or ovarian) in 12·5% of the cases. The majority were over 40 years of age.

Conservative treatment was adopted in the majority of cases (primary hysterectomy in 6 cases only) and resulted in a very low mortality (1 case), i.e. 1·4%.

Puerperal septicæmia or pyæmia developed in 6 cases. 9% of these subsequently developed chorion-epithelioma.

Secondary hæmorrhage during the puerperium occurred in 15% of the cases. Out of a total of 10 cases that developed this complication 4 were due to the development of chorion-epithelioma in the uterus.

Two other cases of chorion-epithelioma are known to have developed, neither of which developed secondary hæmorrhage.

Thus the incidence of chorion-epithelioma known to have occurred in this series was 6, i.e. 8·3%. One of these 6 cases was a malignant perforating hydatidiform mole.

Eight other cases of chorion-epithelioma occurred during the same period of years, 2 of them being in males.

The value of the pregnancy tests of Zondek-Aschheim and Friedman is illustrated and the importance of assessing them in relation to the other clinical and laboratory findings is stressed.

The ultimate prognosis of cases with proved chorion-epithelioma is unexpectedly good in this series.

Fertility after a hydatidiform mole pregnancy is frequently perfectly normal.

My sincere thanks are due to Mr. Eardley Holland, Mr. Victor Lack, and other members of the London Hospital Honorary Consulting Staff, for the use of their case-records.

[*A pathological demonstration of macroscopic and microscopic specimens was arranged to illustrate such cases as had particular interest.*]

Discussion.—Mr. J. B. BLAIKLEY said that he had recently seen eight cases of hydatidiform mole and had noticed how varied the symptomatology had been. Three patients had shown gross albuminuria and a high blood-pressure, one of the three was œdematous from the waist down and had a great deal of ascites; another had been operated upon for torsion of an ovarian cyst and forty-eight hours later she aborted a vesicular mole. Obviously the cyst was a lutein cyst. In two of the eight cases severe sepsis had followed in one, an acute infection of the uterus with *Bacillus welchii* was treated with serum, the patient had almost recovered.

The following case would probably be of interest. A 2-para complained of four weeks' continuous loss following seven weeks' amenorrhœa, diagnostic curettage was carried out and a hæmorrhagic piece of tissue removed, while bimanual examination showed a soft swelling attached to the left side of the uterus. Microscopic examination showed a rare variety of hydatidiform mole in which the vesicles were surrounded by fibrous tissue six or seven cells deep. In view of the swelling felt, a Friedman test was made and on more than one occasion during the following month gave a negative reaction. However, as the swelling had increased in size it was decided to readmit the patient to Guy's Hospital for laparotomy. Operation showed the isthmus of the Fallopian tube and the cornu of the uterus to be distended by what appeared to be a hæmorrhagic tumour, total hysterectomy was performed and the left appendage removed. Microscopic examination showed the mass to consist of a few villi and much blood-clot. This case was of particular interest, if for no other reason than the fact that the pregnancy test was negative. The converse of this case was that of a primigravida, who gave a history of six weeks' amenorrhœa followed by ten weeks' slight

bleeding, and was found to have an asymmetrical uterus enlarged up to the umbilicus. The Friedman test produced a positive reaction in dilutions of 1 : 2000, which was thought to be conclusive evidence of hydatidiform mole and abdominal hysterotomy was performed ; an angular pregnancy was found, but apart from blood between the membranes and some hydramnios, it was normal ; the uterus was curetted through the incision. The Friedman reaction remained positive in dilutions of 1 : 200 for fourteen days but was negative after a month. These two cases bore out what Mr. Brews has said about caution in assessing the results of a pregnancy test in the diagnosis of this condition. Dr. P. M. F. Bishop who performed the Friedman tests at Guy's Hospital had reported 300 consecutive tests with only two erroneous results.

He differed from Mr. Brews in accepting a case of perforating mole as one of chorion-epithelioma, as he did not consider perforation of the uterus to be evidence of malignancy. It had been shown that the mole eroded the wall of a vein and ramified along the lumen until it came to lie under the peritoneum, when it might again erode the thin wall of the vein, and also the peritoneum, quite easily. There was no true perforation of the muscular wall of the uterus.

Professor JAMES YOUNG said that Mr. Brews had raised the question as to whether a true malignant condition was possible in hydatid mole. Professor James Miller, some years ago, had reported a case in which after death masses of tissue were found in the lungs which consisted of chorionic villi exhibiting marked invasive properties. This case was reported in the *Transactions of the Edinburgh Obstetrical Society*.

With regard to the occurrence of hydatid mole in one placenta of binovular twins, he (Professor Young) had had a case of this nature some years ago. Both fœtuses were present and, whilst one placenta was apparently normal, there was an area of hydatid change affecting the other.

Section of Psychiatry

President—DAVID FORSYTH, M.D.

[*April* 9, 1935]

The Problems of Out-patient Clinics for Psychoneurotics

By J. R. REES, M.D.

IT is perhaps not unnatural that one whose interest is largely directed to this particular field should consider that the problem of the provision of adequate efficient out-patient treatment for psychoneurotic patients is a question of paramount importance.

Probably all of us are faced with the difficulties of arranging adequate treatment for impecunious psychoneurotic patients who live in areas of the country which are less well organized for such treatment than is London. Which, one may ask, are the localities (in order of preference) in which you would advise residence for anyone who was obsessional, wanted treatment, and was poor? Or again, if you have to advise the Magistrates' Association, what list of areas can you give them in which the Courts might obtain helpful reports on the psychological state of sexual offenders and other delinquents, and where treatment can be arranged for such of these adults and children as will benefit by it? Most of us can, and do, answer such questions —up to a point—but we are aware that there is a lamentable shortage of such facilities and that we do not know of all of those which actually are in existence. There is, in all probability, much competent psychotherapeutic treatment available of which we hear nothing, except by chance. We need fuller reports of the Local Authorities' clinics, and of all the other similar activities in the country.

Throughout this paper, in writing of out-patient clinics for this group of patients, it is assumed that in such centres the treatment of choice is psychotherapy. Under that heading I include the methods of persuasion and psychological re-education, suggestion, mental analysis—of whatever type—and the team methods of the child guidance clinics.

This rash assumption is based primarily upon personal judgment. It is impossible to find any published comparison of the permanent results of the treatment of psychoneurotic patients by the old out-patient method with the results in a similar group treated by the newer psychotherapeutic approach. This assumption of the necessity for psychotherapy is nowadays, in London at any rate, fairly general. It was not without significance that the critical observers at the Maudsley Hospital found psychotherapeutic measures necessary, both in their in-patient and out-patient practice. It is equally noteworthy that the cautious reports of the Board of Control have also been quite clear on this point in the last few years.

If doubt is felt about this point, the onus of disproof might perhaps be said to lie with those hospitals—and there are some notable examples—which still have a disinclination to provide psychotherapeutic treatment for their neurotic patients.

At a meeting of this Section it is unnecessary to stress again the importance of this much neglected group of disorders. From both the medical and the sociological points of view we are becoming increasingly aware of the necessities of the situation. We have all read the figures produced by Culpin's researches and few of us can have

any doubt of the general accuracy of Gillespie's estimate that one person in thirteen in this country is in need of psychological readjustment. It is, however, worth calling attention to the confirmatory evidence adduced in a paper by Dr. Halliday, Regional Medical Officer of the Department for Health in Scotland, in two recent Supplements to the *British Medical Journal*. A careful, and very conservative, survey of 1,000 patients referred to him as being incapable of work, showed that over 33% of them were, in fact, suffering from psychoneurotic disabilities. Although he has not yet been able to confirm the fact, he states his belief that the same percentage of psychoneurotic illness is found in the group of persons who are less seriously ill and therefore not referred for his opinion. Many of us have, for long, suspected that this was so, and that diagnoses such as debility, anæmia, and gastritis often masked psychological disturbances, but apparently this is the first statistical survey which has been made to demonstrate the facts. We have therefore, as psychiatrists, every reason to feel that the situation is challenging and that it behoves us to be clear as to the methods by which society can best deal with the psychoneurotic problem.

The latest figures made available, by the courtesy of the Child Guidance Council who recently made a widespread inquiry, show that there are in this country (including Wales and Scotland) 162 clinics or early treatment centres in existence; 20 of these are child guidance clinics, and of the remaining 142, some 98 report that they see children as well as adults. The information available does not, unfortunately, give any accurate idea of how much treatment is carried out in the various clinics; a great many of them are known to provide only a diagnostic service, and it is safe to say that less than half are able to make any serious attempt at psychotherapeutic treatment.

If we may draw conclusions from the most recent report of the Board of Control on the Local Authorities' clinics and add to those figures the voluntary organizations of which we know, we should probably discover that there were only about 30 centres in the whole country providing psychological treatment for impecunious adult patients. Nothing further need be said on such general lines as this, though no opportunity should be lost by any of us in emphasizing the complete inadequacy of our treatment facilities.

Turning now to the more specific problems which arise, we shall be wise to think first of the very material question of the location of such clinics. Some of the existing centres are actually located in mental hospitals, a great number of these clinics are arranged in association with general hospitals and are regarded as being amongst the special out-patient departments of the hospital, while a certain number are housed in separate buildings which have no spatial link with either general or mental hospitals.

It is hard to find anything to be said in favour of the first arrangement. The psychoneurotic patient is in almost every case frightened of insanity (as he understands it), and many years of education will be necessary before the bulk of the patients who need help will be willing to seek it early, if they associate treatment with the hospitals which are, in the main, dealing with more serious mental disorders.

The arrangement by which the psychiatric or psychotherapeutic clinic forms an integral part of a general hospital's out-patient system is theoretically entirely sound and, in many cases well-known to all of us, has proved a great success. The only arguments against it seem to be: (1) That systematic psychotherapy, for such patients as need it, is not helped by the necessarily bustling atmosphere of the out-patient department; (2) if the clinic is large, the space needed and the hours during which the clinic should be open, are very often not possible to arrange for in an existing out-patient department. The psychoneurotic patient as a rule appreciates, and is helped by, a quieter and less institutional (even, one might say, less typically medical) atmosphere. White coats and a crowd round the dispensary

hatch must tend to perpetuate for many patients the longing for a nice easy physical method of treatment. Physical illness is still "respectable," as compared with " nerves " or a " mental disorder " and it is certainly pleasanter to swallow a bromide mixture than to lay bare one's soul—though possibly sometimes less effective. There is, however, no doubt that the location in a general hospital is very near to the ideal situation. This group of patients whose disorders are intermediate between the " physical " and the " mental " are, on the whole, far more nearly within the scope of the general hospital than within that of the mental hospital. At any rate, they themselves are quite convinced that they are. It is, moreover, very important that those responsible for the treatment of the psychoneuroses should maintain a close touch with general medicine.

It is probable that in many localities the best situation for the psychiatric clinic would be in a separate building of its own, adjacent to the general hospital or close enough to allow for very intimate co-operation, but yet possessing an atmosphere of its own. It should have definite linking arrangements with both the general and the mental hospital, drawing on the services and the beds of both, using the staffs of both for clinical and educational work, providing experience for the nursing staffs of both hospitals, and receiving some of its patients from both.

Such an arrangement would give the psychiatric clinic the best of both worlds. It would have all the advantages which come from such links, and at the same time it would be free to carry out its special work, which of necessity differs a good deal from that of either of the other hospitals, demanding more medical time, less nursing, more of the sociological approach, and more privacy.

The clinic should be so arranged that it is capable of functioning as—and possibly developing into—a psychopathic hospital for the area, comparable in many ways with the Clinical Units in the United States to which that name is given. The local authorities should be responsible for the costs of treatment for such cases as derive from their areas, but the psychiatric clinic should have a somewhat greater degree of freedom than it might have were it simply part of the local council's activities, and should be able to take patients, when necessary, from any area. The more efficient it is, the wider will be that area.

There may be difficulties at the present time in organizing such clinical facilities with this degree of autonomy, but it is an ideal which is worth considering, and at which we should aim.

There are certain real advantages in having a clinic which deals with both adults and children. We, at the Institute of Medical Psychology, have found many advantages in this arrangement whereby we have a Children's Department working as a Child Guidance unit, but in the same premises and with a certain overlap of staff. The fact that the difficulties and problems of children are treated in the clinic tends to remove some of the atmosphere of abnormality which might affect adult patients adversely. The impression of the segregation of nervous or mental patients is not so acute, and the fact that children are receiving treatment and help in straightening-out their difficulties is often found to be of real value to adult patients in giving them a truer perspective on the nature of their own complaints— so largely the result of their own early upbringing.

Many situations arise in the treatment of children in which it is necessary to treat the parents, before the child can be given the right background and freedom at home. The existence of an adult department alongside the Children's Department makes this a good deal more simple.

From the point of view of the training and provision of experience for doctors, it is of considerable importance to have a Children's Department. It may be open to doubt whether child psychiatry can be effectively carried out by those who have little or no experience of adult psychotherapy. It is a truism that the analytic treatment of adult patients gives a greater degree of insight into the psychological

mechanisms of childhood than can be obtained in almost any other way. Such knowledge and experience are invaluable for the child psychiatrist who, of necessity in most cases, has to find—and wishes to find—shortened methods of helping his patients to adjust.

All these arguments in favour of combining a Children's Department with an adult clinic for psychoneurotics are subsidiary to the main premise that the only form of treatment for mental illness which can truly be called early treatment is the treatment of the difficulties of childhood. However urgent the need for the relief of adult suffering, the prophylaxis of mental illness, which is far more important, is best served by the provision of treatment for children.

In considering the type of patient who will come to the clinic, our experience has shown that, curious though it may sound, it is necessary to emphasize to the medical profession and the social agencies and the public, that the clinic is not attempting to deal with those who are mentally deficient. The ignorance about such matters in this country is such that a very large number of people who ought to know better do not differentiate between mental defect and psychoneurosis. The clinic which gets a reputation for dealing with defectives will certainly have no chance of serving many of those who should be its patients.

Of the straightforward psychoneurotic conditions which are sent to such clinics, our figures show that the bulk—some 48%—are cases of anxiety neurosis ; about 13% are cases of conversion hysteria ; another 11% fall into the group of the obsessive-compulsive neuroses ; neurasthenia comprises only 2%, and the rest of the patients fall into various groupings—depressive and schizophrenic states—personality problems in children and adults, disorders of conduct, and cases from the Courts which are sometimes not easy to classify.

The number of psychotic or pre-psychotic patients who are referred to us is comparatively small. Under 2% of those who are seen for a preliminary consultation are referred to mental hospitals, while approximately 3% necessitate that recommendation after one or two further interviews or at a later date—in all, 5% at the outside. So far as can be gathered from the last published figures of the Maudsley Hospital, 5·4% of the out-patients who are seen are referred to mental hospitals. The figure from the Guy's Hospital Psychiatric Out-patient Department is much lower than this, and works out round about 2%—a very interesting fact, since it seems to indicate that this clinic is doing its job well and having very early cases referred from other departments of the hospital.

If we take the Board of Control Report and its summary of the figures from a group of out-patient clinics which are reported to be the most effective in their work, we find that from the eight clinics whose figures are given, 22% of the out-patients seen in consultation are admitted to mental hospitals.

There is a very big difference in these figures, which must have meaning and be of considerable importance. It is hard to believe that the types of illness amongst the general population in the areas which are served by these particular Local Authorities' clinics—Cardiff, Dorset, the Isle of Wight, Kingston-upon-Hull, Portsmouth, Sunderland, Swansea and Wiltshire—differ materially from the disorders which are found in London.

The explanation must lie largely in the fact that psychoneurotic patients are not referred so freely to these clinics. The reason for this may be that they were begun as a result of the Mental Treatment Act, and that they are staffed in the main by our colleagues who are known to be connected with mental hospitals and who are, therefore, supposed to be interested primarily in the borderline, or pre-psychotic, type of patient. It may, of course, also be true that the doctors in these areas feel that these new clinics are as yet primarily diagnostic in their function, and realize that they have not, for the most part, given proof of their ability to treat the psychoneuroses.

There is some evidence, however, that the Board of Control has encouraged those who are running these clinics to look for the pre-psychotic type rather than the psychoneurotic. On page 1 of the Board of Control Report for the year 1932, we read :—

" It is natural that at the outset these clinics should attract the chronic neurotics who are the despair of every general hospital. But even for these cases something may be done, and there is no justification for regarding any clinic as a failure because at the start it does not attract the early case of mental disorder for which it is primarily intended."

On the other hand, in the Report for the year 1931, on page 52, the Board recognizes that psychoneurotic disorders *are* mental disorders :—

" Anything which will help to produce, either in the mental hospital or out of it, the physician who is familiar with the cause and treatment not only of advanced mental disorders but of those conditions familiarly referred to as ' nerves ' will be not only to the good of the patients themselves, but to the advancement of Medicine."

The early treatment centres that the Mental Treatment Act envisaged were surely not intended only, or even primarily, for the pre-psychotic patient. Since the problem of the psychoneurotic persons in this country is, from the numerical and the economic points of view, so much greater than the sufficiently big problem of the psychoses, the thought and the organization of Local Authorities should be guided in the direction of more adequate facilities for this group of patients.

The functions of the clinics which we are considering fall into two main groups—diagnostic and therapeutic. The consultative service for the purposes of diagnosis and advice as to disposal must always be one of the important functions of any such unit.

Even without available beds, it is possible for a clinic to act fairly effectively as a clearing-house for the local hospitals, the local practitioners, social services and the law, in the same way that a fully organized psychopathic hospital might do. The provision of beds for observation in both types of hospital, general and mental, will certainly increase its efficiency.

Every clinic has to accumulate a body of knowledge regarding the various facilities which exist for different groups of patients. It is not merely the Almoner's Department or the trained psychiatric social worker who is involved ; the psychiatrist himself has to be *au fait* with the possibilities of various forms of social help, with the problems of the Courts, Probation, Remand Homes, and Prison, and the possibilities of boarding-out foster-homes, with employment difficulties, and many other problems, in addition to the straightforward matters of institutional care and treatment. The greater the psychiatrists' interest in these problems of disposal, the more valuable will be the service of the clinic to the community.

A great many persons will be referred by magistrates or probation officers to the clinic, for reports and advice, if it is discovered that the advice given is of practical value. Many of these cases are referred after conviction and before sentence. There our responsibility is great, in that it will depend largely upon our advice whether the sentence passed results in some form of effective treatment or not. Many of the patients who are referred will be so because of marital difficulty or others of the multifarious problems which are brought to the Courts for decision. Even in one psychiatric consultation, aided perhaps in certain cases by intelligence tests and social investigations, it should be possible to give valuable advice which will influence the whole course of treatment in many cases. Under such circumstances we have an even more important task than the consultant has in giving advice to the general practitioner.

Important though diagnosis and the disposal of certain types of case may be, the main function of the clinic should be therapeutic. It will fail in this function unless it sets out to provide careful individual treatment, as opposed to the more

rapid methods which must necessarily obtain in a crowded out-patient department. It is only when the clinic proves that it can provide a type and quality of treatment which produces results that its existence is justified and its value to the community assured.

The suggestion might be advanced, that at the present time it is better to limit our psychotherapeutic efforts to the more intelligent of our patients, the black-coated workers, the artisans, &c., and if we do not provide an out-patient department on traditional lines ourselves, to leave such less intelligent patients as come our way in the general hospital out-patient department. Medicine and didactic treatment are likely, for them, to produce results fully as good as any that we could get with an investigation of the psychopathology of these conditions. Prophylaxis, through social and environmental measures, seems to offer the best chance for this section of the community in the future.

It is perhaps debatable whether there should be some definite age-limit fixed for admission to a psychotherapeutic clinic. Certainly, through its parents, a child of but a few months old can be helped. Many of us have seen successful analytical work done with people of 70. Mainly from the point of view of a cumbersome waiting-list we, at the Institute, have made an upper age-limit of 55. The group of men and women round about 40 seem to show the best results of any age-group.

No one would be in doubt, so long as he remained detached in his judgment, as to whether a clinic should aim at quantity or quality of work. The validity of the psychotherapeutic method rests upon the factor of quality, but more important still is the fact that from the patient's point of view and from the social and economic aspects, the radical cure of a psychoneurosis—a finished job—is what matters. This finishing of the job is even more important than in surgery, for the effects produced on his family and environment by the well-adjusted individual or, conversely, by the uncured psychoneurotic, are materially greater than those resulting from surgical conditions and their sequelæ.

In face of a crowded waiting-list and many urgent cases, it is often far from easy to keep one's judgment and to be firm in this matter. In the psychiatric clinic— a recent innovation in medical practice—we should, however, aim at maintaining an even better standard of treatment than that in other general or specialist hospitals. Difficult though it is to achieve, it pays to provide treatment which is every bit as careful and accurate and unhurried as it would be in private practice. The waiting lists about which many of us groan are, in fact, a help to the quality of our work. If every new patient accepted as suitable has to be taken on for treatment, it can only be done by hurrying the discharge of others, or by reducing the time given to other patients, that is, assuming that we cannot increase our numbers of suitable psychiatrists.

A fundamental decision has usually to be made about the policy of any clinic. The main interest of its physicians may lie along the lines of description and classification, while, on the other hand, they may be mostly concerned with ætiology and psychopathology. These two lines should not be mutually exclusive, but there is some slight danger of their being so. The second alternative is probably better for the patients; in any case it needs adequate representation on the staff of any clinic such as we are discussing.

The next problem which arises is that of the medical staffing of an out-patient clinic. Beyond all question, the better the medical staff are equipped with a knowledge of general medicine and a knowledge of the psychoses, the more efficient will the work of the unit be. These, however, are not sufficient qualifications, for psychotherapy cannot be carried out very effectively by those who have not had special training in that branch of medicine. However many doctors the clinic employs, the bulk of them should be trained psychotherapists or, at least, men and

women who are in training to become such. The psychotherapist has to be specially chosen—much more so, indeed, than any other type of specialist in medicine. Academic qualifications may be a rough guide to the efficiency of the general physician or the surgeon, but they are no indication of ability to deal with the psychoneurotic patient. The personality and general approach to the patient, the amount and quality of experience of life that the doctor possesses, are far more important criteria of suitability for this type of work.

Of recent years, since we have had regularly organized courses in psycho-therapeutic theory and method at the Institute, we have insisted on every would-be student interviewing at least three members of the staff, so that we may pool their judgments as to the suitability of the individual. We have turned down as many as we have taken on, such discrimination being only fair to the patients, as well as to the doctors who are proposing to spend time, money and effort on training.

It is probable that mildly pathological motives are responsible for the majority of people's interest in psychopathology. For that very reason it is extremely important that psychotherapists, other perhaps than those who are proposing to employ simply suggestive methods of treatment, should themselves have a training analysis. If the staff of a clinic were to consist of only two physicians, then one of them should have had special experience in psychotherapy and in analysis. If the staff be a large one, then an increasingly high proportion of the doctors should be selected for such qualifications. From the point of view of the ability to deal with complicated psychoneurotic disorders, and also from the point of view of the training of local practitioners, who may work in the clinic, this is extremely important. It is certainly a *sine qua non* that in every clinic there should be one psychiatrist with such training.

The Board of Control, in their report for 1929 (page 4) referred to the necessity of having medical officers with special experience for dealing with the out-patient problem. Clearly, they were foreseeing this very point.

" These clinics . . . cannot function effectively without the appointment of Medical Officers with special experience in this branch of medicine assisted by trained mental welfare workers who undertake the social side of the work."

In the 1931 Report (page 51) they recognize that, necessarily, psychotherapeutic methods differ from those used in the treatment of mental disorders.

We are therefore, as members of a specialty, faced with a very important problem in this question of suitable training. The psychiatrist who has been trained and who has gained most of his experience in a mental hospital, gets very little special knowledge or training to help him in dealing with this larger group of illnesses. Even the work for the Diploma in Psychological Medicine, as at present planned, vitally important as its actual syllabus is, seems to have much too little reference to psychopathology or to psychotherapeutic method.

There has been in medical discussions and also in official reports of the Board, a tendency to imply that lengthy mental hospital experience is an essential for those who would deal with the psychoneurotic. It is certain that experience with the psychoses is of the greatest value and importance to every psychotherapist, but there is a limit to the amount of such experience that is of use. From the point of view of diagnosis and the assessment of many cases, the psychiatry of the mental hospitals is essential. From the point of view of treatment, the experience and understanding that are needed have to be achieved in quite a different way.

There has been, as we all know, in the minds of very many people a distinction between the two groups in psychiatry. Each group has tended to regard the other with some suspicion and at times it has translated that suspicion into words. This

situation is ridiculous; we shall never reach a satisfactory position while either group tries to stress its superiority.

The problems connected with the detailed working and administration of any clinic must, naturally, depend largely upon local conditions. If we are to attempt to get as near as we can to the efficiency of treatment in private, it is certainly a good plan to insist upon the appointment system for patients. Not only is the harmful gossip of a large group of patients under treatment avoided but the danger of rushing through appointments unduly fast is minimized. The patient has a greater sense of " mattering " to his doctor—a point of some real importance in psycho-therapeutic work—and of course there is, in addition, the question of the patient's convenience and that of the administrative staff. Amongst all psychotherapists who are not committed to the psycho-analytic technique there is fairly general agreement that patients with whom any form of analytic treatment is employed should be seen three times a week if possible. The plan of having treatment sessions only once a week definitely impedes progress; analytic treatment under those conditions takes four or five times as long as it would were the patient seen thrice a week.

The average number of attendances of patients at the Local Authorities' Clinics recorded in the Board of Control's report is 5 or 6; in the group of the 12 best clinics, the average is 7 attendances. No mention is made of the length of time given to each patient's visit. For what it is worth, our experience is that for some years the average number of hours (which means visits) given to each patient has been from 18-20. All of our appointments, save those for treatment by suggestion, and some of the interviews in the Children's Department, are of an hour in duration. The nature of the case and the type of method employed by the physician give rise to very considerable variations in the length of treatment; many of our patients are only seen for five or six hours, while a few may be seen for 500 or 600 hours. Lengthy treatments, though certainly necessary for some cases, raise many difficult administrative and financial problems. We have a system which works well, by which every junior doctor discusses his cases once a month with a senior colleague, and every senior member of the staff who has a lengthy case must, after every 50 interviews, discuss that patient with some colleague whom he chooses. With a large staff this is certainly a wise plan which tends to keep the interest of physicians focused on the necessity for shortening treatment whenever it is justifiable.

The question of payments by patients for their treatment is not merely a matter which concerns the financial position of the organization. It is important that every patient should pay the ethically correct fee that he can afford, however small it may be. Co-operation between the psychiatrist and the administrative staff, or the Almoner, on this point is important, since there may be changes in the economic status of the patient. One should be paying more than he is, another should not pay so much, and then, if the adjustments are made, both patients are likely to co-operate better in their treatment and the results will improve correspondingly.

Variety of approach amongst the physicians in any group is sound, and probably in the future we shall be eclectic and more inclined to be Adlerian or Jungian, or to make a deep reductive analysis, according to the particular needs of the individual patient with whom we are confronted. There should be no problem for any clinic in this matter, for every point of view can be welcomed.

Faced by the difficulties of providing treatment for all the patients who need it, our thoughts must constantly turn to the possibilities of providing group treatment of some kind. This can certainly be done in a civilian clinic, as it was in the Army, so long as the treatment is by suggestion, and the number of patients in the group is kept small. Collective hypnosis with a few patients together can be effective and also time-saving.

In our Children's Department we have been running, with some success, a parents' group, in which all sorts of problems which are common to every parent are discussed, and a good deal of time which would otherwise have to be spent with individuals is thus saved.

Nothing has been said about the problems of the Children's Department of a clinic because these have been dealt with on a number of occasions recently in discussions on child guidance methods. There seems no doubt that the team method of handling the difficult child, with adequate co-operation between psychiatrist, educational psychologist, and social worker, is the best scheme of treatment which can be devised. A slavish adherence to the method is inadvisable, but with the problems of children our main line of treatment will always be environmental, rather than analytic.

The Social Service Department of a clinic is of use, not only for the children, but also for adults. Some adult patients would be intolerant of any organized social investigation, but the trained psychiatric social worker is of incalculable value in dealing with many of the problems that confront us in any clinic. There has been a certain tendency recently to decry the value of their special training. Granted that they are, to start with, the right people, their training gives them qualities of insight and understanding which are considerably in advance of those possessed by any other group of social workers.

Reference was made earlier to the educational and prophylactic aspects of treatment. Every patient who comes into successful contact with the Clinic is going to do something towards the better adjustment of his family and his friends. The parents of the children who are treated, especially since they quite rightly feel themselves in the majority of cases to be taking part in the treatment, react in the same way. The social workers, from whatever organization they come, and the Courts which send patients to the Clinic, gradually acquire an increasing insight and understanding of matters psychological which is well worth having. Quite apart from special lectures and training which may be organized for the medical profession in the vicinity, the fact that the doctors of the clinic spend time in writing full and careful reports to the family physician is an important piece of educational work. The application forms of the Institute of Medical Psychology have provided an interesting demonstration of this. Many of those doctors who have previously sent cases on which they have had full reports, give evidence, on filling up their section of the application-form, of a steadily increasing interest and understanding of their neurotic patients, and this is a point of considerable importance as, in addition, this care in correspondence wins the confidence and the co-operation of the family doctor.

It is stated that the incidence of tuberculous disorders is on the wane; preventive work and education in hygiene are producing their results. In the same way, we may certainly look forward to the problem of mental ill-health of all kinds being attacked more adequately, so that in fifty or sixty years from now it will have ceased to be a major problem in medicine. Education in matters of mental health and the availability of efficient treatment will go far to eliminate the psychoneurotic disorders, though we must not be Utopian and assume that all mental illness will disappear. Those of us who are working in this field during that period will be faced with many problems—one of the chief of which will be the insufficiency of trained psychotherapists.

With the increasing public realization of the need and value of psychotherapeutic treatment there will be increasing voluntary support—unless some new government decides to nationalize all voluntary hospital work. Until that time the financial aspect of out-patient clinics needs careful thought. The time necessitated by psychotherapeutic treatment is so serious a matter that the cost of treatment in

private will prevent most of those who need such treatment from obtaining it, and the State will have to bear a considerable part of the financial burden.

At the moment, the provision of part-time salaries, some by the Home Office and some by the local Public Health Services, for suitably trained physicians, is an urgent need. It is difficult to visualize how else "backward areas," such as Yorkshire and many other counties, are to organize their services. Such part-time posts would give a chance for the development of private practice, and if that could be done the quality of the work would be well maintained.

Such encouragement as this is needed if we are to see the best of the younger men and women in medicine attracted to the most interesting, and perhaps the most important, specialty in our profession. What development is to come about in this field depends mainly upon how we run our out-patient clinics and upon the type and quality of the service we provide for the community.

Section of Surgery

President—PHILIP TURNER, M.S.

[*March* 6, 1935]

DISCUSSION ON THE TRAINING OF A SURGEON

Professor G. Grey Turner : The object of this discussion is presumably to consider the training of those who intend to devote themselves to the practice of surgery exclusively. (I do not like to use the word " specialist," although it is sanctioned by usage and delights the public.) Before dealing with the training of the surgeon proper, however, I feel it wise to say a few words on the training of the student preparing for a qualifying examination, as this certainly has some bearing on the problem. There appear to be two principal points of view. There are those who think that students should be so educated in surgery that they may be expected to go anywhere and to carry out any sort of surgical proceeding, operative or otherwise. The idea underlying this view is that our Empire is far-flung and that we should educate men to be able to fulfil their responsibilities to the patient in whatever out-of-the-way place they may find themselves. As, however, modern means of transport are more and more banishing remoteness, this argument, although it may have been a very potent one in the past, is certainly of less moment at the present time. The other point of view is one which suggests that we should thoroughly ground our students in the principles of surgery and that we should give them only an introduction to the art of operative surgery. To my thinking the latter is the proper plan, especially in consideration of the very heavy claims on the time of the student made by our overloaded curriculum. So far as operative surgery is concerned, I have endeavoured always to inculcate a thorough knowledge of the principles of surgery, so that in unusual circumstances the young practitioner may be guided by such knowledge rather than entirely by routine. In addition I have tried to familiarize students with emergency surgery—that surgery which is concerned with the saving of life or limb—and, thirdly, to train them thoroughly in minor surgery. So far as the other aspects of operative surgery are concerned, I have always considered that it is enough if they know something of the scope of the operative treatment which may be required, the indications for such treatment, the risks and attendant disability and the results that are to be expected. I think it is quite unnecessary that they should be burdened with the details of major operations like gastrectomy, or the transplantation of the ureters, or the division of the sensory root of the Gasserian ganglion. So much, then, for the training of the ordinary undergraduate in operative surgery.

Now, with regard to those who intend to devote themselves entirely to surgery, are we to aim at turning out mere technicians or craftsmen—" surgical plumbers " as they are sometimes dubbed—or should the surgeon be a well-trained pathologist

and diagnostician, with something of the experience and training of the physician, but skilled in all that appertains to operative methods of treatment? I hope that we are all agreed that the latter is the proper view to take. Before we talk about how we may best attain this object, I think we must remember that in every age many surgeons, and of the best type, have evolved from other walks of life, and especially from among the ranks of the general practitioner. It will not be time entirely ill-spent to consider the guidance of history in this matter. The career of Ambroise Paré is well known, and his education by constant practice and sound experience has often been commented upon. William Hunter recognized the paramount importance of hospital practice in the training of the surgeon, for he it was who said : " Were I to make a man truly great in his profession I should place him in a large hospital where he might attend the sick and dissect the dead." John Hunter sought the foundations of his art in the study of structure and of function and their derangements, and he based his practice on this knowledge. James Syme so felt the need of clinical opportunities that early in his career he founded his own hospital. Paget—whose life and work had such an immense influence on the surgeons of his day and after—had a long training in physiology and pathology, but had very little practice in actual operating, with the result that it came to be said that you should go to Paget to find out what was the matter and to Fergusson to have it removed ! Joseph Lister was thoroughly trained in the method of science, first by association with his father, who had a wide knowledge of optics, and secondly, by the good fortune which brought him under the influence of Sharpey and Bowman in his early days. One might go on with innumerable illustrations, but these are sufficient to point the various ways by which men have reached the same goal.

I think it is worth while asking ourselves what our own education has been before we presume to tackle the problems concerning the surgical education of the surgeons of the future. In the case of many of us the approach to surgery has been through the dissecting-room, and in not a few instances the idea of taking up surgery was put into people's minds by study for the primary Fellowship examination. Undoubtedly, the next most important factor has been the time spent as a surgical registrar and, in my own case, I believe that the five years during which I worked in that capacity provided the most valuable training of my career. During that period a good deal of time was spent in laboratories in connexion with physiology and bacteriology, and such time was certainly most valuable. Then I think that we must all recognize the extreme value of the association with some surgeon to whom we virtually stood in the relation of apprentice, and from whom we were able to learn so much of the rules of the art and the way to achieve success in their application. In my own case I count myself fortunate to have been associated with that great surgeon, Rutherford Morison, during the most formative years of my life. But, in looking back, one recognizes the lack of a wide general education and of adequate training in the methods of science. It would also be better to have spent much more time actually working at applied physiology and bacteriology. Many of these defects were the consequence of the necessity of making a living and generally making one's way in the world, but, at the same time, there were many advantages. It taught one early to be self-reliant, and it was in many ways an advantage, for there were not so many departments about our hospitals and schools to which problems could be referred. For instance, we had to do more in the way of interpreting our own pathology and, sometimes, bacteriology, which was all to the good. The most important advantage, however, which seems to be denied the junior surgeons of to-day, was the privilege of making surgical post-mortem examinations and the training to which that led.

But what of the surgeons of to-morrow? For that, indeed, is our responsibility, as we will be expected to guide those who intend to take up surgery as a career. First of all, we must beware of too great rigidity in any system. I am particularly alarmed at those plans which are arranged according to a set number of hours which must be devoted to the individual subjects. When all is said and done, any system that is devised can only be judged by results, and once again let me say that we have always to remember that surgeons have, over and over again, evolved in spite of the defects of any special education.

First then, with regard to the raw material. It is important that in choosing a man to go in for surgery, we must remember that it is a matter of the heart as well as the hands for, after all, a surgeon cannot escape being a doctor ; he may be a most excellent technician, but without judgment, a knowledge of human nature, and sympathy, he is unlikely to have the great success his technical excellence ought to command.

With regard to preliminary education, I think it is a great mistake to be too early devoted to the entirely modern and scientific side, and I would like to put in a plea for the study of the humanities, which so greatly help to widen the outlook and give that understanding of human nature which is so important. Further, some such outlook is a great antidote to many of the anxieties which dog the footsteps of the busy practising surgeon. I would like to stress the value of early nature-study as a grounding in the important education of observation, and I do not think we can afford to neglect the lessons to be learned from the serious perusal of " The Adventures of Sherlock Holmes," which, after all, was founded on the actual work of the Edinburgh surgeon, Joseph Bell. An early training in the use of the hands is also valuable, and nothing can be better than carpentry, boat-building or model-making. It is also essential that our young aspirant should be thoroughly trained in the method of science—the grammar of science, so to speak—and it is on this foundation that his study of pure sciences should be built up. It will also help to carry the knowledge of those sciences into his daily work, and to observe continuity in their use rather than their consideration in purely water-tight compartments.

All our preliminary education must lead up to the surgeon being a doctor, for in any of the specialities one must first be a doctor, and I would strongly recommend that a training as a house-physician, followed by a short period in general practice, is an excellent preliminary groundwork on which to found a subsequent surgical career. After qualification and the medical appointments which I have mentioned, the best training for a young surgeon is that undoubtedly gained in serving a post in a great hospital. Let him get inside a big institution where he will be able to fulfil the dictum of William Hunter by tending the sick and dissecting the dead. It is essential that he should have plenty of clinical opportunities combined with a certain amount of responsibility. During this time it is important that he should not have too much operating. Opportunities for actual operating should certainly be given, but only with discretion, as these years are so valuable that they should not be wasted in merely doing a lot of routine surgery. The preliminary investigation of cases, the care in the after-treatment and the study of the pathology, and some piece of research are far and away more important than mere operating. It is true that the education of the craftsmanship in surgery must not be neglected, but it must not take a major place at this stage. While holding such a post, the young surgeon should be carrying on work in laboratories ; anatomical research and pathological research are most important. Such research need not require the use of expensive apparatus, or necessarily of animal experimentation, but it should be a concentrated personal effort to find the

solution to some problem with a bearing on surgery. During this time it is a great privilege if the young surgeon can be associated with a chief of wide outlook and ideas, combined with an enthusiasm which exhibits itself in an eagerness for the welfare and accomplishments of his pupils. In looking round, one cannot but recognize that there are some surgeons who beget surgeons; they are makers of surgeons, whereas in the case of others, their aptitude, their art, and their experience are not handed on, and too often die with them.

After these early years the training in surgical craftsmanship must be continuous; it develops by practice, by the example of others, and in response to responsibility, but it is a great misfortune that in the result the difference between good and bad surgery is often apparently so small.

Now may I say a few words on matters which deserve the attention of surgeons. In the old days often several years were spent in the study—or I think it might better be said, in the practice—of anatomy. There is still a great deal to be learned from anatomy, but it is a great mistake that it should be studied in too much detail—I mean, studied for the purpose of memorizing. The anatomy that is useful in actual practice is the anatomy of various regions, and often as seen through operation incisions, but when it comes to the finer points then there cannot be too much detail—as, for instance, in connexion with the blood-supply of the ureter or the exact anatomy of the œsophagus. It is a great thing to be able to know where to get the information required, and I cannot help recalling John Hunter's retort to someone who suggested that his lack of knowledge of the dead languages was somewhat of a handicap. Hunter replied that " he could teach him more on the dead body than ever he would learn from any language either living or dead." The moral to be learned is that when anything is to be found out we should be ever ready to go back to the soil.

In physiology, what we require are opportunities for experimental work, and especially such applications of physiology as can be dealt with on the living human body. This clinical science is gradually being recognized, but the full value of the field has, I am sure, not been sufficiently appreciated. Bacteriology, also, should be studied and used as an applied rather than an abstract science. In that matter a thorough knowledge of the development of surgical technique is essential, and I cannot imagine any better course than a study of the work which led up to Lister's discoveries or the sort of work outlined in Lockwood's book on aseptic surgery.

I would also like to mention the importance to the young surgeon of travel—of going about from centre to centre and seeing how things are done in other schools and fields of activity. Such travel need not always be abroad, and a sort of " Cook's tour " of the hospitals of London will prove very valuable and often entertaining. Once the habit of visiting is engrained it becomes natural and the range of the traveller should be ever widened. Then again the value of writing must never be overlooked. As Bacon said, " Writing maketh an exact man," and I make no apology for mentioning the importance of this habit. Disputation is also of great value and that is one of the chief uses of the medical and other societies.

In these days a good deal that is scathing has been said about examinations and especially about the examinations for the Fellowship of the Royal College of Surgeons of England. But, after all, the interest of preparing for an examination certainly promotes study, often sets a course to our activities, and tends to drag application from our reluctant selves.

When all is said and done, we are forced to recognize that the education of a surgeon is not something that can be compressed into a short period. It must be gradual and it is certainly life-long, and those best able to profit will always find

themselves with the most to learn. Like everything else, surgeons should evolve, and any devotion to the special branches can only properly be acquired by one thoroughly trained in practice in the whole art of general surgery. Nothing can be worse in the cultivation of a speciality than too narrow or too unequal a foundation.

Dr. Arthur Hurst: It is unfortunate that the examining bodies have insisted upon so much of the preliminary scientific training required for the medical curriculum being done at school, as it leaves insufficient time for other subjects. My impression is that the general education of medical students is not so good to-day as it was formerly. This is indeed hardly surprising, as the general education for many boys now ceases at the age of 14 or 15 when they begin to specialize in chemistry and physics or biology. A physician or surgeon who wishes to keep up to date should be able to read French and German as easily as English, but probably less than 5% of medical students can read German and less than 20% French. This is in striking contrast with what occurs in Scandinavia and Holland, where every medical student must be able to read English, French and German, and at Harvard and Johns Hopkins, where no students are admitted who cannot pass an examination in French and German. Some extremely important recent work in Germany on the pathogenesis of gastric and duodenal ulcer has never been translated into English, and anyone aspiring to be a scientific abdominal surgeon who cannot read the original loses a most important source of education. Boys should be encouraged to spend some months in France or Germany after leaving school and before entering a medical school, and they would derive much pleasure and profit from another visit during their first long vacation.

With regard to the primary Fellowship examination, I wonder how many surgeons here this evening know any details about the development of the tentorium cerebelli. Yet that question, which many professional anatomists would find difficult to answer, was asked at the last examination. The fact that such a question can appear in an examination paper means that candidates must prepare themselves in an enormously wide field, including much that is absolutely useless. It would be a great advantage if the primary Fellowship could not be taken until after qualification, as it is impossible to devise a standard suitable both for the student who has not started his clinical work and for a qualified man, who could occupy his time much more profitably than in learning physiological and anatomical facts which have no conceivable connexion with the science and art of surgery.

The ideal surgeon is a physician trained in the practice of surgery. Instead, therefore, of surgical appointments from the moment of qualification, the surgical aspirant should spend six months as house-physician before being house-surgeon. When both appointments cannot be held at his own hospital he should act as house-surgeon elsewhere, thus gaining a wider experience than is generally the lot of the surgeon on London hospital staffs, who too often receives the whole of his medical education in his own school.

Operations on the abdomen, the chest, and the nervous system should be regarded as incidents in the course of medical treatment. Failure to realize this is the cause of the absurd rivalry which still exists between the claims of medicine and surgery in the treatment of such diseases as gastric and duodenal ulcer. Every patient with ulcer should be treated medically. If recovery is unduly delayed or is incomplete, an operation should be performed with the object of making complete recovery possible with further medical treatment. The ill-results of surgery are largely due to the operation being performed by a surgeon whose surgical technique may be perfect but whose training has been too purely surgical. If he is a physician practising surgery, he will realize that the safety of the operation and the prospects of a satisfactory result are enormously increased by preliminary medical treatment,

which converts an acutely inflamed ulcer into a quiescent ulcer with comparatively little associated gastritis. He will realize that the suture line, and also the ulcer if it has not been excised, will heal more rapidly and completely if the treatment is just as strict after the operation as before.

Another example is the surgery of carcinoma of the stomach. Every house officer should know that it is possible to bring the hæmoglobin percentage of such a patient, however anæmic he may be, up to 80% within a fortnight and at the same time to make the inside of his stomach clean and aseptic instead of dirty and swarming with bacteria, but cases admitted direct into the surgical wards of a hospital are too often operated upon with little or none of the preliminary treatment which would reduce the immediate mortality by at least 50%.

One of the most useful methods of improving the training of the surgeon—and incidentally also of the physician—would be the regular institution at all teaching hospitals of combined rounds, in which the physician and the surgeon see and discuss each other's cases in the presence of their house-officers, ward-clerks and dressers.

Mr. J. Paterson Ross: The training of a surgeon may be discussed from three aspects, considering surgery as a craft, surgery as a branch of medical science, and surgical specialization. I wish to make it clear at the outset that in my opinion it is a mistake for a young man to devote his attention particularly to surgery before graduation. It sometimes happens that, either from inclination, or because he may have passed the primary examination for the Fellowship of the Royal College of Surgeons, a student, before beginning clinical work, makes up his mind that he is going to be a surgeon. If he does this, however good his intentions may be, he will tend to neglect the greater things of medicine as a whole and to concentrate from the beginning upon a narrow field, thus permanently restricting his outlook and falsifying his sense of the importance of surgery.

The advice of Thomas Vicary is as good to-day as it was in 1577 :—

"Every chirurgion ought to be learned and that he know his principles, not only in Chirurgerie but also in Phisicke, that he may the better defend his Surgery."

I would go further and say that it is an enormous advantage to a young surgeon to have been house-physician to a good clinician from whom he could learn not only to elicit physical signs but also to appreciate the natural healing powers of the body.

Should an undergraduate student be determined to try to fit himself for a surgical career he is not to be encouraged to spend his spare time in operation theatres, but he should learn to read and speak French and German, he should study the history of science, or at least the history of medicine, and he should also take a proper amount of exercise in the open air. A strong and healthy body is essential if a man is to stand the strain of a surgeon's life.

If special training in surgery is postponed until after graduation, there is a chance of picking the right man to train, for although anybody with a good pair of hands may acquire the necessary technical skill, a man must be endowed with certain attributes of the mind if he is to learn wisdom. Though he must have resolution so that he may be able to make decisions quickly and to act promptly, he must also have the faculty of self-criticism to enable him to learn from his errors of judgment ; and though it is essential for him to develop self-confidence, yet it must be tempered with humility and open-mindedness without which he will become more neglectful of his own shortcomings, and less appreciative of the virtues of his fellows.

After a year as house-physician, the aspirant to surgery should next spend six months improving his knowledge of anatomy and physiology so as to reach the standard at present required at the primary Fellowship examination. I do not wish to infer that I regard examinations as an important item in a surgeon's training, but I mention the primary examination because, though it is open to criticism in certain details, its real function is to insist upon a considerable knowledge of the preliminary sciences. The application of such knowledge underlies all recent surgical progress, for example in the surgery of the urinary tract, the central and sympathetic nervous systems, and the thorax ; and the intelligent use of irradiation and diathermy as adjuncts to surgery demands a certain familiarity with matters formerly considered to be beyond the scope of surgery. It may be argued that the study of the preliminary sciences should be completed before commencing clinical work, but in my opinion a revision of preliminary science in its application to surgery is of the utmost value after graduation and before beginning to concentrate upon learning the craft of surgery.

Training in the craft of surgery.—The craft of surgery, as now practised by the great masters, is hardly capable of much advancement, but this does not mean that the training necessary to obtain the mastery is any less arduous than it has been in the past. On the contrary, operative technique demands concentration upon more numerous matters of detail than ever before, and may be learnt only by watching, assisting, and being supervised by one who is himself a master of the craft. The increase in the scope of surgery has made it impossible for any one man to be highly proficient in all its branches, yet proficiency in any branch means the nearest possible approach to perfection in the practice of the same fundamental principles— asepsis, gentleness and the control of hæmorrhage. These are the things which our disciple, when he is a house-surgeon, must learn from his chief, and which he must learn to practise himself in the human body. I do not believe that it is possible or desirable that surgical technique should be learnt by operating upon the lower animals.

But daily contact with a great surgeon teaches his assistants much more than mere manipulative skill. By watching his chief at the bedside, a house-surgeon may learn not only how to make a diagnosis but how to cultivate a sound judgment, and from the personality of his master he obtains inspiration and enthusiasm and the indefinable influences which unconsciously enrich his clinical experience and his character.

As the house-surgeon approaches the latter part of his term of office he should be given more and more operating to do, but always under the eye of the master, and usually with his assistance. It is pathetic sometimes to hear from a recently qualified man that a certain house appointment is worth having because of the large number of major operations " you can do on your own." This is excellent at a later stage in the career of a young surgeon, but if not properly supervised in his early days he is likely to develop bad habits which are often hard to eradicate.

When a young man has been house-surgeon for a year it should be possible to decide whether he is to be encouraged to make surgery his life's work or not. If the decision is in favour of his carrying on he should spend another year as resident surgical officer, preferably at another hospital, where he will have an opportunity of taking rather more responsibility and of discovering for himself where difficulties lie and how they may be overcome. I suggest another hospital because in his own school, he is apt, almost without being aware of it, to rely too much upon the advice of his seniors, whereas away from home he will have to stand more on his own feet, though he must be able when in difficulty to appeal to a surgeon whose judgment is sound and who is willing to give instruction as well as good counsel. It goes without saying that both of these surgical house appointments should be held in the general surgical service.

To be away from his own hospital for some time will also make clear to him the importance of visiting other surgical centres so as to study modifications of technique and treatment. A surgeon cannot begin too young to make a practice of visiting clinics where good work is being done, a practice which will enable him to continue to improve his own craftsmanship throughout his career. These visits, he must remember, are to be paid not in a critical spirit, on the lookout for the things which are done better at home, but with a pure heart and an inquiring mind which will ponder over the ideas and suggestions which arise from seeing the work of other men.

Training in medical science.—While it is essential for a surgeon to become a skilled craftsman, it is also necessary, if he is to do good work and to develop his surgery along the right lines, that he should cultivate methods of accurate observation and logical deduction. Surgical advance involves the conception and design of scientific experiments which demand highly trained faculties of observation, as well as critical scrutiny and careful evaluation of the evidence obtained therefrom. The best-trained surgeon must therefore be able to employ surgery not only as a therapeutic method, but also as an instrument of research, and I wish to consider briefly how he may be fitted for this work.

I have already suggested that from the very beginning he may obtain help and inspiration from the study of the history of science, for the analysis of the circumstances which have led to discoveries and advances in the past can give some indication of the line which future developments may be expected to follow, and of the factors which are likely to influence the progress of surgery. As a house-surgeon, he should try to make all his clincial observations as accurately as possible, always remembering, however, that his patients are human organisms and not pieces of scientific apparatus. He will thus begin early to recognize the difficulties inherent in clinical science, and to learn the wisdom of not jumping to conclusions. But I think he should be prepared to devote himself for a period of two years to work in a laboratory where he may be trained in scientific methods and may undertake some original investigations under the direction of a research worker. This should be a part-time occupation, and he should be given facilities for co-operation with clinicians, and for maintaining close contact with clinical problems.

It is because it presents an opportunity of living in a scientific atmosphere that work in a physiological or pathological laboratory is of value, and the mental attitude thus acquired is of much greater value than mere knowledge of physiology and pathology, though this in itself is a great asset. Anatomical research also gives wide scope for the exercise of observation and deduction, for the modern anatomist is physiologist as well, but it seems to me to be a mistake for a young surgeon to spend many years demonstrating regional anatomy. That a surgeon must have a sound knowledge of anatomy has been stressed already, but an understanding of physiology (including biochemistry) and pathology is the only sure guide to the discovery of the best methods of helping patients to withstand and to recover from the strain of operations, for the development of surgery which aims at the correction of disordered function, and for determining the role of surgery in the treatment of infections and in the fight against malignant disease.

It falls to the lot of a fortunate few to work at an institution such as the Surgical Research Farm at Downe, but I do not believe that a training in animal experimentation is essential for a surgeon. Though it has its uses in investigating procedures which cannot be tried out initially on man, and though it may be of value in helping to elucidate the problems of pathology, our aim should be to devise accurate methods of recording physiological reactions in normal human beings and of studying the deviations from the normal in disease, and so to make a direct attack upon the much more perplexing problems presented by sick men and women. It is

in making such observations and in controlling their accuracy that a surgeon will appreciate the value of a preliminary period of laboratory training.

Specialization.—The front line of modern surgery is so extensive that nobody can hope to be able to lead the advance in every sector. It is therefore a good thing for a young surgeon to make a special study of a circumscribed field, with the object not only of achieving a high standard of manipulative skill in the performance of certain operations, and of obtaining wide experience of the clinical features of disease in certain organs of the body, but also in the hope of being able to add something to our knowledge of the process of disease in these organs. Such knowledge, however, is often of value in throwing light upon the problems of general pathology, and in the same way the final result of concentrating upon a special field in surgery should be to enhance the resources of general surgery. The tendency for young surgeons to neglect general surgery and to specialize without completing their general training is to be deplored. The detailed study of a subject which a young surgeon can make his own should enrich general surgery instead of contributing to some minor speciality which cannot grow to its full stature or take its proper place in medical education or practice when divorced from general surgery. Even those who wish to practise ophthalmology, laryngology, and otology should have a training in general surgery first, and the aim of those who concentrate on any of the other so-called specialities should be to standardize their methods so that the general surgeon may be able to adopt them, and thus to raise the standard of surgical practice in all its branches.

It is of the utmost value to a young surgeon beginning the study of a special subject to spend six or twelve months working in a clinic which is pre-eminent in that particular field, and if the clinic is situated abroad this will afford him still further opportunities of adding to his experience of men and of surgery. When this phase of his training is completed he must be given an opportunity of working at his own problems, but as a member of the general surgical service of a hospital. To offer such facilities to a young man is, I think, one of the functions of surgical professorial units, and the encouragement of such special work confers benefits which every member of the unit may share.

Mr. McAdam Eccles said he believed that although a surgeon had to be born he also had to be trained. His own old teacher, Lockwood, had impressed observation upon him, and its value was enormous. In regard to the primary Fellowship, speaking as an examiner, he was certain that examination on the living subject was essential.

He wished to emphasize the value of operative surgery, not only in the operating theatre, but also in the post-mortem room. He thought education by cinema films was really valuable in the early days of the budding surgeon; present-day films had now reached wonderful excellence, even in minute detail.

Mr. P. T. Crymble : A surgeon's training may be divided into three periods—the school days, the university days, and the post-graduate period. At school German, French and drawing should receive special attention. I am not in favour of school science, but I am in favour of the classical education. In the university one cannot too strongly emphasize the importance of the resident pupilship, during which the student lives for three months in the hospital. This period of residence should be taken in the fifth, or final, year. I agree with Mr. McAdam Eccles that operative surgery on the dead body is of great value. Intestinal operations can be practised on ox intestine, bone-plating and the use of saws can be learned on bones ; amputations and ligature of vessels can be carried out. If the class includes a study of sectional anatomy and radiograms, it may become very popular and interesting.

After qualification, one year should be spent as a house-physican and house-surgeon, and then comes the most crucial point in one's whole career. Is one to enter a science department such as anatomy or pathology, or is one to become permanently attached to some surgical clinic? Opportunities for the latter are very rare, and in my own school anatomy has been the main corridor to surgery. Two years might safely be spent in an anatomy department, not with the idea of becoming a demonstration hack, but rather with the view of learning again the anatomy of the body, learning to lecture, to become familiar with normal X-ray anatomy, and to carry out research under the guidance of scientists. The art of writing papers and their delivery must be learnt. During these two years the summer vacation should be spent in a large London hospital, and at the end of this time a Fellowship should be obtained

The fourth post-graduate year should be spent in a large continental centre, with special attention to pathology. This is not the time to watch operations. In after-life, when one has had certain experience, great benefits may be derived from short visits to surgical clinics where the details of operations and methods of diagnosis can be learned. One must form some opinion on the question of specialization in surgery. Are we to live in water-tight compartments such as genito-urinary, orthopædic, brain, chest, abdomen, fractures, and goitres, or should each general surgeon have a special sideline? Doubtless the former scheme develops in large centres, but with a population of one-and-a-quarter million it is impossible to make a living in this way, and consequently the second method has come into operation.

In Ulster we have no specialists—we are all general surgeons, each with a special sideline.

Finally, I should like to say that whilst attempting to raise the standard of British surgery we should not forget to educate the Government, public bodies, and the man in the street, so that they may realize that an efficient surgical service is not merely a question of marble halls and stainless steel, but is a question of men, and that one requires many years of post-graduate training and many years of apprenticeship to a master before one is capable of taking charge of a surgical unit.

Mr. H. Collinson said it was impossible to define any exact course of training for a surgeon, but the most important thing was that he should have as wide a field of experience as possible before devoting himself to surgical practice. He should, if possible, hold appointments both as a house-physician and house-surgeon, and at the Leeds hospitals they frequently managed to arrange this. The developments of special departments, orthopædic and fracture clinics, and the consequent removal of large numbers of cases from the general surgical outpatient department and in-patient beds had created difficulties in the teaching of undergraduates and the training of hospital residents. Though special departments might be of benefit to the patient they made a wide and comprehensive experience difficult of attainment for the young surgeon.

With regard to the importance of travel and the visiting of other hospitals, it would be a good thing if promising young men who had held the post of surgical tutor or registrar were assured that if they spent some time away from their hospital in study elsewhere they would not lose their chance in a subsequent staff appointment, and that their having done this would be a recommendation rather than the reverse. It was necessary that every good surgeon should be a skilful craftsman, but it was even more important that a surgeon's training should be so planned that he could acquire that sound judgment and clinical experience which would enable him to decide what to do, and, particularly, how much to do.

Mr. Seymour Barling : The surgical training of our younger men may conveniently be divided into two stages : (1) The period of what we may call " apprenticeship," during which they are free to study at their own hospital, or elsewhere as seems desirable, seeking the best which the world can give where it is most available ; (2) the period when they become members of staffs, when opportunities are more circumscribed and there is a danger of a narrowing of educational efforts as the result of increasing responsibilities and duties. Looking at the matter in this light one realizes (possibly too late) the extreme value of the first period, and occasionally I have noticed that a man wishing to avail himself of any opening which may present itself has been reluctant to travel and study, for fear that during his absence an opening might occur for which he would have been a likely candidate had he been on the spot.

It has been our custom at Birmingham for some years, in cases where a vacancy on the staff can be foreseen, to make the appointment a year in advance and give the successful applicant a year's study leave, the hospital paying his expenses during this year out of the staff fund, if he is not the possessor of a scholarship or other funds for the purpose. Such a plan has much to commend it, for not only does it prevent what one may call in-breeding in the school, but also, inasmuch as specialist surgery is concerned, it allows a man to develop along lines which are most suitable to produce a balanced hospital staff.

When a vacancy occurs which has not been foreseen, a similar plan is aimed at, though the study leave may have to be curtailed or taken in shorter periods.

There are many other points in which hospital administration touches the subject. Surgery is essentially a handicraft, and although other factors—such as judgment—may come with increasing years, yet the handicraft must be learnt young, and this implies beds in his own right from the moment a man comes on the hospital staff. The importance of this point is not yet sufficiently recognized by hospital boards or even by some senior staffs. In my own school we have a graduated plan— the assistant, commencing with four beds from the moment of his appointment, gets six after five years and eight after ten. Finally he will, as soon as our present building plans are complete, share the beds equally with his chief after serving for fifteen years.

This plan of placing the apportionment outside the range of chance has much to commend it ; it allows the junior to develop his surgery along his own lines from the moment he is on the staff, and perhaps also allows him to view the robust health of his senior with a more friendly eye !

Mr. Herbert Paterson emphasized the importance and value of a classical education, and agreed with Mr. Grey Turner that there was much to be said for the old system of apprenticeship, for in one's early days, nothing was of greater value than to be associated with a good chief, and he himself gratefully acknowledged how much he owed to the experience gained during the years when he worked as private assistant to the late Mr. Harrison Cripps.

During his schooldays, every surgeon—indeed, every boy—should have a thorough training in carpentry.

He criticized the system prevailing in London by which a budding surgeon was often compelled to spend several years in the dissecting-room. Such time would be spent to much greater advantage in working at experimental physiology and pathology. He thought that the London hospitals were overstaffed, so that the junior surgeons, in order to have more beds, held appointments at more than one hospital, which led to a dissipation of energy.

He cordially agreed that every surgeon should have held a post as house-physician. He would go further and suggest that the more, and the more varied,

house appointments held by the aspiring surgeon, the better. Even residence in a fever hospital would prove of value to him.

He advocated strongly that every surgeon should have held an appointment as anæsthetist for at least six months or one year. Surgeons learned by their mistakes. Experience as an anæsthetist gave the future surgeon the opportunity of learning from the mistakes of others, and so enabled him to avoid some of the pitfalls lying in wait for him. The anæsthetist, too, gained knowledge as to the limitations of surgery, for by his experience in administering anæsthetics, he learnt to gauge the resisting power of the patient in long operations.

A surgeon might be defined as "a physician who has learnt to use his hands," hence the importance of a thorough knowledge of medicine. Professor Grey Turner had said that the surgeon should be more or less of a physician. He (the speaker) would go further and say that the surgeon must be the Complete Physician.

Mr. Zachary Cope said that it was difficult for some young surgeons to spend as much time as they would like in visiting foreign clinics and in broadening their general education because of the great amount of routine work thrust upon them and the exiguous state of their finances. It was regrettable that many of the junior surgical posts were either unremunerated or inadequately paid.

The **President** said, with regard to the value of the study of anatomy in the post-graduate training of a surgeon, after a year as medical registrar he had spent five years in the anatomical department. Though a certain amount of training in anatomy was advantageous, he considered that the greater part of this time should be occupied by appointments which provided opportunities of acquiring experience in clinical and operative surgery and in pathology.

The development of special departments had provided a difficult problem in the pre-graduate stage of surgical training. He had found that undergraduates up for their final examinations knew, as a rule, very little of the diagnosis and treatment of cases usually referred to these departments. This was no reflection on the excellent work done there. It simply meant that this was essentially for post-graduates and assumed a higher standard of general surgical knowledge than most undergraduates possessed. He thought that the remedy was that each special department should work in close co-operation with a general surgical unit, with combined rounds by the surgeons-in-charge, so that the application of general surgical principles to the diagnosis and treatment of special cases should be constantly brought before the student.

He would recommend literature as a hobby. This did not mean necessarily reading a great many books—comparatively few would do, provided they were the best. This would encourage concise and lucid expression, and would be of great help in writing papers and lecturing.

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Section of Surgery

SUB-SECTION OF PROCTOLOGY

President—W. ERNEST MILES, F.R.C.S.

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[*March* 13, 1935]

DISCUSSION ON THE RADIUM TREATMENT OF MALIGNANT DISEASE OF THE RECTUM AND ANUS

Sir Charles Gordon-Watson: In November 1927, as President of this Sub-Section, I passed in review 15 cases of carcinoma of the rectum which I had treated with radium, combined with the surgery of access, during the previous two and a half years.

I am now in a position to summarize my experiences, based on 149 personal cases treated with radium since March 1925, many of which have had two and three applications.

It is perhaps significant that whereas up to the end of 1931 I had treated 140 cases, I have only dealt with 9 cases during the past three years.

My attitude at present is to observe what happens to patients treated in the past and, unhappily, to note their gradual disappearance from the list of survivors, to learn what lessons I can from these and, at the present time, to employ radium only :—

(1) *In operable cases when operation is resolutely refused,* or is contra-indicated on general grounds.

(2) *In selected inoperable cases* where the growth is not too large and is sufficiently accessible to permit of a uniform irradiation, after a colostomy has been performed and metastasis excluded.

(3) In selected cases *to insert radon seeds* at the time of the colostomy *into the region of the retro-rectal glands,* if glands are palpable, when an excision is due to be carried out later (i.e. in the C cases).

(4) In cases of *limited perineal recurrence.*

Radium and the operable case.—I have only used radium for the operable case when a radical operation has been refused or has been contra-indicated on grounds of old age or some infirmity.

Although I can produce a few cases of complete and prolonged cure of early carcinoma of the rectum after treatment with radium without colostomy, I cannot advise it in preference to radical surgery, because the results are too uncertain.

In several instances after an apparent cure, recurrence has followed or a fresh growth has appeared in a new situation, and excision has had to be performed in the end. Many of us have had similar experiences with the breast.

There are other disadvantages in treating a small operable growth with radium :
(1) An overdose may be followed by a stricture and make a colostomy compulsory.
(2) Failure to destroy the growth may produce fixation of the bowel at the site of the growth and not only make a subsequent excision difficult, but also impair the chance of a permanent cure. If time permitted I could give examples illustrating these points.

Variations in radio-sensitivity.—It is of interest to consider why in one operable case a brilliant success can be secured, while in another apparently similar case complete failure results, in spite of similar technique. Why is one growth radio-sensitive and another radio-resistant? Is it a histological or a biochemical problem, or is it a question of general constitutional resistance rather than of local resistance? Probably all these factors come into play. One thing is clear from my own experience, and that is, that the more rapid the growth, the less differentiated the histology, and the younger the patient, the more sensitive are the growths to radium, but it is necessary "to get up very early"—so to speak—to secure a permanent cure in these cases, because in these cases early metastasis must be expected. Most of my cases were dealt with before we had established a system of grading adeno-carcinomata on a histological basis as we now grade all growths that are excised, so that the very important question of the influence of histology on results cannot be answered definitely.

Radium versus local excision.—It is doubtful whether radium is any better than a local resection in the very early operable case when either is considered possible and advisable without the aid of colostomy. I am not referring here to the operation known as "conservative resection," as practised by Grey Turner, but to a local removal of mucosa and submucosa with a free margin. I have in the past frequently carried out a local removal for very small mobile growths, hoping to be successful, but have hardly ever been so in the long run.

Malignant sensitivity.—The fact is that we are not simply dealing with a small carcinoma of the rectum, but with a rectum which is potentially malignant. Cuthbert Dukes has done much to enlighten us on this point; he has shown the close relationship of hyperplasia, adenoma, and carcinoma, and has also demon-strated the frequent presence of small adenomata around a carcinoma.

It is especially interesting to note that whereas these satellite adenomata are quite common when the carcinoma is young, they tend to disappear as the malignant growth advances in age. Their disappearance rather suggests that malignant growth is the final aim of a mucosa which has acquired, through hereditary tendency, the desire to run riot.

Hyperplasia is followed by adenomata, and sooner or later a carcinoma develops. Once this mucosa, which is endowed with a malignant sensitivity, has given expression to the end-result of its riotous intentions, and that result is fully established, it appears to have no further use for the simple tumours, and they retrogress by inhibition.

Experimental work.—It is well known, in experimental work with tarred mice, that when papillomata form, an epithelioma appears sooner or later, but usually not more than one at a time. If this is removed, and the animal survives, another appears to take its place. The presence of the malignant growth seems to inhibit the further production of malignancy, and its removal seems to remove the inhibition. We frequently see this both in radium treatment and in the surgery of the rectum, when the surgery is not radical.

Radical methods the only safe course.—The fact is that, once a rectum has given expression to a malignant tendency, there is no safety for the individual short of a radical excision, at the earliest possible moment, of the whole of the potentially malignant area, however small the growth. This is a hard saying and it requires courage to act up to it.

The inoperable or border-line case.—I have shown cases to-day which prove beyond doubt that even the most advanced cases of carcinoma of the rectum can be destroyed with radium, and that the patients can be restored to perfect health.

It is to the credit of radium that this cannot be accomplished in any other way. Why is it then that the percentage of cures is so small?

The answer, I think, must often be that the failures are due to some flaw in

technique.   If this is so, then with increased experience, improved methods, and more knowledge of the action of radium and the causes of radio-resistance, we should expect a higher percentage of cures in course of time, although probably there will always be some growths so highly differentiated that they are almost as radio-resistant as the normal epithelium.

One reason for the want of progress with radium in rectal cancer is that it has been given a bad name.   Mr. W. B. Gabriel, in his work on rectal surgery, has expressed his conviction that radium has no place in the treatment of rectal cancer, except by the use of intra-rectal radon seeds as a palliative measure.   The patients whom I have shown, and others whom I could show, owe their lives, which are both healthy and active, to radium.

A fiat has gone out from Paris that adenocarcinoma is radio-resistant, and so most of the radium centres have not persevered with its use or carried out researches to ascertain the causes of failure.

Another reason for the small percentage of cures is that the essentials for efficient irradiation of most of the inoperable growths are very difficult to secure.   Unless the entire growth receives a uniform irradiation with a sufficient amount of radium, for an adequate period of time, failure is almost sure to follow.

The difficulties of access due to the situation and shape of the rectum are obvious. The depth of growth varies in different parts and is not easily ascertained.   To a considerable extent success will depend not only on uniform distribution and a flat field, but on the amount of radium employed per cubic millimetre of growth and also on the amount of filtration.   It must be obvious that to get the best results, except in the very accessible low growths, surgical measures are required to give good access and long experience is required to gauge the correct amount of radium and its filtration, the manner of its distribution, and the length of time for which to leave it in.   Better teamwork, increased knowledge with regard to histological grading, a general acceptance of the same standard of grading ; and the establishment of a unit of gamma irradiation as definite as the r-unit of X-rays, are all required before we can advance much further.   I believe that less radium is required for the high grades than for the low, but for all cases of adenocarcinoma heavy doses with heavy filtration (preferably 0·8 mm. of platinum) and long duration (200 or more hours) give the best results.

Radium and pain.—When a colostomy has been performed in an inoperable case, in most instances the patient is relieved of previous pain and discomfort unless, owing to extensive ulceration and fixation, the sacral somatic nerves have already become involved.

There is some risk of producing pain when no pain has been present if a colostomy is followed by irradiation, especially with an overdose, and occasionally of increasing existing pain by an ineffective attack on an inoperable growth.   If the tumour regresses and pain is not relieved the patient has gained little ; and if regression is achieved at the cost of pain, which before was absent, the patient is a loser.

Radium should not be used in the presence of secondary sepsis or when the growth has spread beyond the bounds of the rectum and is so extensive as to prevent a complete barrage.

If the entire growth is accessible and an appropriate dose is delivered in a uniform manner (in some instances both from above and below, through the abdomen, by the perineum, and intra-rectally) the growth can be destroyed, and if it surrounds the bowel a fibrous stricture will usually result so that the patient may remain free from pain and other symptoms for a long period.   A few of these, as has been seen to-night, will be cured.   The percentage of such success, in the inoperable cases, is small, and here I cannot emphasize too strongly the importance of using every endeavour to avoid sepsis, if success is to be obtained.

In the young and middle-aged, if a radical operation is considered out of the question, an attempt should certainly be made to save the patient's life, provided that the above conditions can be met. The cases shown to-day illustrate the value of making the attempt.

The border-line case.—When the growth is "border-line" and not definitely inoperable, radical surgery should always be attempted in the young and middle-aged, but in the old and infirm, operations on the border-line cases have a fairly high mortality. In these latter, when operation is not considered wise, life can often be prolonged after colostomy by an efficient irradiation, which may convert the bulk of the growth into fibrous tissue, lock up the remainder of the malignant tissue and render it inert—perhaps for a number of years, and so often allow the patient to reach his natural term without metastasis and without the unpleasant symptoms so often associated with an active growth.

Conversion of inoperable cases into operable.—It is worth while to note that in three instances I have irradiated a fixed inoperable growth after colostomy, and the growth has shrunk and become mobile so that an excision has been possible later on. One of these patients is free from recurrence nine years after excision. One died five years later with metastasis in the spine, and the other is now dying of secondaries in the spine six years after excision, having enjoyed more than five years of relief from symptoms.

Technique.—I have an impression, possibly not well-founded, that interstitial irradiation has a liability to stimulate distant metastasis, sometimes in unexpected locations, and I am inclined to think that when it is possible to get an efficient barrage without actual penetration of the growth, this is advisable.

The last case dealt with was attacked on these lines. The growth was posterior, deeply ulcerated, and firmly fixed to the sacrum, involving half the circumference and about 3 inches of the bowel in the upward extent. Long needles were passed upwards between the growth and the sacrum, through the skin, a special trocar and cannula being used. The inner surface of the growth was irradiated by suturing a piece of corrugated rubber, threaded vertically with long needles, to a rectal tube passed down the colostomy and out through the anus. The rubber sheet was sewn to the tube after it was drawn outside the anus, and then folded round it. The tube was then drawn up until the radium was in position. The sheet was then unfolded and packed against the growth with gauze, and the lower end of the tube was stitched to the anus to keep the radium in position. I think that perhaps we shall return to the use of intra-rectal surface radium in combination with peri-rectal interstitial radium in selected cases.

I have on a previous occasion here, and in several papers, described the various other methods I have adopted and time will not permit me to refer to them now, but I have a strong preference for the use of radium, when possible, with its constant action, rather than for radon, which loses its force when the fight is nearing the end, and just when a knock-out blow is required.

I can only deal briefly here with squamous carcinoma of the anus. Early cases do well with radium and are much less resistant than rectal cases ; the rectum with its sphincters can often be preserved intact and no colostomy performed. If glands are present in the groin they must be dissected out and the area treated afterwards either with surface radium or deep X-rays.

If glands are not palpable surface radium or X-rays should be employed for the groins as a prophylactic measure. Advanced cases do badly whether with surgery, radium, or X-rays. I will show some slides illustrating the results of treatment of epithelioma of the anus.

Dr. W. Levitt has treated a number of inoperable cases for me with deep X-rays at St. Bartholomew's Hospital, and has authorized me to make the following report :—

" The treatment of carcinoma of the rectum with deep X-rays still remains unsatisfactory, and in spite of every effort to improve the technique, the results have shown little or no improvement during the past few years. It is true that a certain amount of palliation can be obtained in a proportion of cases, but it is doubtful if life is much prolonged. Pain may often be allayed, discharge from the rectum reduced, and the rectal growth itself may shrink in size and its ulcerated surface even heal over for a time. After a short period of relief, however, reckoned by weeks or at most a few months, progress of the disease again occurs, and further X-ray treatment is found to be ineffective. Curiously enough, it is often found that deposits in glands, or local deposits in scars, respond better than the primary growth itself, and such deposits may completely disappear following X-ray treatment and may not recur ; even if recurrence does eventually occur, the period of freedom may run into many months, or even a year or two.

" The failure of rectal growths to respond to X-ray treatment would appear to be due mainly to an inherent lack of radio-sensitivity in the essential cell of the growth. That these growths *can* respond, however, to X-ray treatment when sufficient dosage is administered is suggested by the behaviour of the glandular and isolated secondary deposits referred to above, which are more superficially placed than the primary growth, and are thus accessible to more intensive irradiation. It is hoped that with increase in the voltage at which X-ray machines can be run, trial may be made of X-rays of the shorter, more penetrating, wavelengths, and that these will permit of the effective delivery of larger doses to the rectal growths, while it is also possible that there may be a selectively more destructive action on the cancer cell from the use of shorter wave-lengths."

Conclusion.—I do not think we should despair with regard to the radium treatment of cancer of the rectum. My friend, Mr. Gabriel may prove to be right in the long run, but I am convinced that his condemnation is premature. I have shown that every now and then even the most desperate cases can be controlled and cured with interstitial radium, and I think it possible that with increased knowledge and experience better results can be obtained. I have some hope that when higher voltage X-rays come into use—e.g. the million-volt apparatus which is about to be installed at St. Bartholomew's Hospital—the deeper penetration of the shorter waves may help to improve results, and I trust that those who are working with massive radium teletherapy will give it a fair trial for carcinoma of the rectum. Adenocarcinoma has been neglected by radium workers because it has a high measure of radio-resistance, but I am convinced that when the threshold of gamma or X-ray intensity is secured its resistance can be broken down in a certain percentage of cases, and lives thereby saved which otherwise would be lost. If some lives can be saved which are otherwise doomed, we ought not to consider the failures.

CASES

Summary.—All the cases were regarded as inoperable and in every case the growth was fixed. All the patients are now in excellent health and free from any evidence of carcinoma. Two were irradiated without a colostomy. The intervals of time after irradiation were $7\frac{1}{4}$, $6\frac{1}{2}$, $5\frac{2}{3}$, $5\frac{1}{2}$, 5, $4\frac{1}{2}$ years respectively.

(I) A postman, aged 44, was treated for a fixed inoperable growth involving the supraperitoneal portion of the rectum and completely surrounding the bowel. Evidence of ulceration was obtained with the sigmoidoscope.

January 2, 1928 : Exploratory laparotomy. A growth was found adherent to both bladder and sacrum. Pelvic colon adherent to growth. Liver free.

A first stage colostomy was performed, followed by transperitoneal irradiation with radium needles. Four needles of 3 mgm., two of 2 mgm. and three of 1·5 mgm. were threaded longitudinally through the muscular coat round the growth and the attached threads brought out of the abdomen through a rubber tube. The needles were left in for 115 hours.

Dose.—20·5 mgm. (filtration 0·5 platinum) for 115 hours = 2,357·5 mgm. hours.

No abdominal symptoms resulted from the irradiation.

The bowels were opened with the aid of paraffin alone, and the second stage of colostomy was not carried out.

At the end of three weeks no ulceration was visible with the sigmoidoscope, and four months later the mucosa appeared normal, though the lumen of the bowel was narrowed.

The general health of the patient rapidly improved, and he gained 2 stones in weight in the first six months. The bowels were open regularly without aperients. He returned to his duties as a postman, and has continued to work with uninterrupted good health ever since.

The colostomy opening epithelialized over, after the glass rod was removed, without surgical aid, and no hernia has resulted. It is now seven years and three months since the patient was irradiated.

(II) E. W., a masseur, aged 37.

History.—Nine months' increasing constipation, with passage of blood and slime.

On examination.—A large fungating growth was found, filling the rectum, involving the whole circumference and extending from 1½ in. above the anal margin to above the peritoneal reflexion. It was fixed in all directions.

October 15, 1928 : Colostomy and transperitoneal irradiation of upper portion of growth with needles. 17 mgm. for 147 hours = 2,499 mgm. hours.

November 7, 1928 : Intra-rectal irradiation 8 radon seeds (2·82 m.c.d.) = 2,476 mgm. hours ; 5 needles 12 mgm. 504 hours = 6,048 mgm. hours.

January 28, 1929 : Intra-rectal irradiation 10 radon seeds (3·3 m.c.d.) = 4,389 mgm. hours. Severe reaction followed.

July 8, 1929 : Rectum smooth and stenosing. Patient gaining weight.

March 1935 : Patient is in excellent health and has gained over 5 stones since the first irradiation. Rectum : Fibrous stricture and no sign of growth. It is now six years and five months since the first irradiation.

(III) W. B., aged 66.

History.—Diarrhœa with blood and mucus for three months.

On examination.—An ulcerating growth was found two inches from the anal margin, extending upwards for three inches and involving the posterior wall of the bowel from 2 o'clock to 9 o'clock. It was firmly fixed to the sacrum.

July 18, 1929 : Posterior barrage *without colostomy*, 38 mgm. for 168 hours = 6,384 mgm. hours.

February 2, 1930 : The only evidence of original tumour was a linear scar on the posterior wall, with some fibrosis in this area. No stenosis.

March 1935 : Rectum feels quite normal. Patient is in excellent health, five years and eight months after irradiation.

(IV) R. D., aged 55.

History.—Three months' rectal pain, bleeding, tenesmus and irritable diarrhœa.

On examination.—The lower edge of a rectal growth was felt 1¾ in. from anal margin extending from 9 o'clock to 3 o'clock. The growth extended up beyond the reach of the finger and was firmly fixed to the structures in front.

September 13, 1929 : Exploratory laparotomy and colostomy (Mr. Paterson Ross). Liver free. Growth did not extend above peritoneal reflexion.

September 30, 1929 : Posterior radium barrage (Sir Charles Gordon-Watson). Rectum exposed after removal of coccyx. 6 needles of 2 mgm. (0·6 filtration) were passed between growth and bladder horizontally and parallel to one another. 6 needles of 3 mgm. were passed along the lines of lymphatic spread. Total dose : 28 mgm. for 210 hours = 5,800 mgm. hours.

March 10, 1930 : Growth entirely destroyed, but there was a small area of submucous nodulation extending from 9 o'clock to 2 o'clock (microscopical examination showed this to be carcinoma). Three radon seeds 1·45 m.c.d. were inserted into this area = 578 mgm. hours.

April 11, 1930 : General health excellent. Horseshoe ridge of scar-tissue from 9 o'clock to 3 o'clock.

November 21, 1930 : Rectum quite smooth and free from recurrence ; has remained normal since. 2B¥C⁰

March 1935 : Excellent health. Normal rectum, five-and-a-half years after irradiation.

(V) B. W., female, aged 31, admitted with history of severe and repeated rectal hæmorrhage for the past twelve months.

On examination.—A soft ulcerating growth was found, involving the anterior two-thirds of the rectum, extending from one inch from the anal margin upwards for about three inches, and firmly fixed to posterior vaginal wall.

January 17, 1930 : Colostomy.

February 17, 1930 : Interstitial irradiation with needles through vaginal wall, 30·5 mgm. for 216 hours = 6,588 mgm. hours.

June 23, 1930 : The growth had disappeared except for a slight submucous induration between 8 and 9 o'clock. Interstitial irradiation with radon seeds ; 5 seeds 1·58 m.c.d. = 1,050 mgm. hours.

October 6, 1930 : Growth destroyed. Recto-vaginal perforation. Subsequent uninterrupted progress.

March, 1935 : No evidence of growth ; in excellent health five years after irradiation.

(VI) J. M., aged 65.

History.—Nine months' diarrhœa with loss of weight.

On examination.—A fixed annular growth was found, beginning 2½ in. from the anal margin and extending upwards above the peritoneal reflexion. It was firmly fixed to the base of the bladder.

October 10, 1930 : Colostomy and transperitoneal irradiation with needles 18 mgm. for 168 hours = 3,024 mgm. hours.

November 11, 1930 : *Posterior barrage* 33 mgm. for 192 hours = 6,336 mgm. hours.

January 9, 1931 : Smooth ring-stricture. No evidence of growth.

March 1935 : Patient has continued in good health ever since and has gained weight. No sign of growth four and a half years after irradiation.

Dr. Cl. Regaud (*communicated*) : Anal and rectal carcinoma has already been the subject of several publications from the Institut du Radium of Paris University.[1] Subsequent experience has not appreciably modified the opinions advanced by the authors. In this short communication I shall recall the indications for treatment as accepted at this Institute, and discuss their rationale.

I.—Carcinoma recti.

It has been known and accepted for a long time that carcinomata of the large intestine, and particularly those of the rectum, are very rarely cured by radiotherapeutic methods. It was at one time considered that these unfavourable results were due to the anatomical situation of the lesion, deep in the pelvis, which rendered intracavital and interstitial curietherapy difficult with regard to technical execution. This difficulty certainly exists, but it is insufficient to explain the bad results. The results are no better—they are indeed worse—when such cases are treated with external sources of radiation—roentgentherapy, telecurietherapy. There are no technical difficulties in external radiation. The cross-fire irradiation of the rectum is no more difficult than the irradiation of the cervix uteri. But the association of radiation from an external source with the classical intracavital radium application has improved the results of treatment of Stage III cervix carcinoma, from the 15% offered by intracavital radium alone to approximately 40%. It is clear that external radiation is effective in the depths of the pelvis, and the difficulties in the treatment of carcinoma of the rectum must be sought for in the nature of the lesion itself, that is, *in an inherent radio-resistance of these tumours.*

[1] REGAUD, CL., " A comparison of cancer of the cervix uteri, buccal cavity, breast, and rectum, in relation to radiotherapeutic methods." *Report of the International Cancer Conference,* Bristol, 1928, and *Radiophysiologie et Radiotherapie,* vol. i, fasc. 3, p. 443.

LACASSAGNE, A., "Résultats obtenus á l'Institut du Radium de Paris en Radiothérapie des Cancers du Rectum," *Arch. des maladies de l'appareil digestif,* 1931, xxi, 465 ; and *Radiophysiologie et Radiotherapie,* vol. ii, fasc. 4, p. 577. In this publication the author has reported the results of treatment of 49 cases treated at the Institut du Radium between 1919 and 1929. There was no case of cure directly attributable to radiotherapy.

The carcinomata of the rectum are not absolutely uniformly radio-resistant. This property depends on the histological and biological type of the cancer, which is to some extent variable. I believe that the most important points to consider at the moment are certain facts concerning the *cellular multiplication, with regard to the differentiation and the secretory activity of the cells.*

(A) The greater number of malignant tumours of the large intestine are typical adenocarcinomata, composed of tubules and lobules of cubical epithelial cells. All the cells are at the same stage of differentiation, which is almost complete. There is no layer of cells which may be regarded as the parents of the remainder. Multiplication of the already differentiated cancer cells to form further fully differentiated cubical or prismatic cells takes place directly without intermediate stages. This type of tumour shows the same order of radiosensitivity as the epithelia, such as that of the intestine and the bladder, which must be traversed by the rays if treatment with an external source is employed. It is impossible to administer a higher total dose than these normal tissues will support and this dose is insufficient in view of the radio-resistance of the tumours. Should external radiation be attempted, we see a slight diminution in the size of the tumour which is, usually, not marked.

The very much larger local dose of radiation associated with the intracavital and interstitial technique leads to a more or less marked reduction in the size of the tumour and in rare cases may result in a cure. These results are, however, only to be obtained at the price of damage to the healthy mucous membrane. It is impossible to obtain a homogeneous irradiation of a tumour of any size with the intracavital and interstitial techniques sufficient to cause the complete destruction of all the cells. The successes are indeed rare and the failures are aggravated by the inevitable radio-necroses with their severe and painful symptoms.

(B) In a certain small percentage of tumours of the rectum the histological appearance is atypical. The least rare type in this group shows a layer of differentiated cubical or prismatic cells, similar in appearance to those of the classical adenocarcinoma; but there is, in addition, a layer of undifferentiated cells which may be more or less extensive, but is always quite distinct. *Reproduction takes place in this layer of mother-cells only.* Occasionally a tumour is found composed entirely of these cells—that is, a completely undifferentiated tumour.

Tumours of this type are definitely more sensitive to irradiation than the classical adenocarcinomata discussed above. External irradiation results in an important diminution and may on occasions produce a cure. The intracavital and interstitial methods of radium application may also be followed by success with doses that are less, and spare the healthy mucous membrane.

Unfortunately these carcinomata, composed predominantly or entirely of undifferentiated cells, are rare in the large intestine and, when they are found, the liability to metastases is more marked than it is in the case of the classical adenocarcinomata.

Indications.—These considerations lead us at this institute to summarize our indications for the treatment of these carcinomata thus :—

(*a*) Operable cases of carcinoma of the large intestine should be treated surgically if the general condition permits the radical operation. There is usually no advantage to be obtained by a preliminary course of radiation therapy but there are workers who assert that such preliminary treatment may convert a border-line case into an operable one.

(*b*) Inoperable cases and patients who refuse operation are subjected to a biopsy. Should the histological examination (which requires some experience) reveal the presence of one of the rare sensitive forms, then radiation treatment is undertaken immediately with X-rays or teleradium using the cross-fire technique. According to the necessities of the case the treatment is preceded by a colostomy. A maximal dose of radiation—suitably protracted and fractionated over the proper time

—is given, in an attempt to obtain the best effect compatible with preservation of the normal tissues.

If the histological examination shows the presence of the common classical adenocarcinoma, which is radio-resistant, then we regard radiotherapy as not being indicated—at any rate not urgently. In the event of signs of obstruction a colostomy is made. This operation itself, removing as it does the chronic irritation of the growth results in a notable improvement which may last a long time. Radiotherapy is not employed to preserve the patency of the lumen, for the end-results are no better than those of the colostomy, which will probably have to be performed in spite of the radiotherapy.

We do recognize an indication for radiotherapy in the final stage of the disease, as a palliative measure for the pain resultant on an extension of the tumour in the pelvis.

(*c*) We have abandoned all forms of interstitial and intracavital applications of radium on account of the extreme rarity of success and the frequency of distressing sequelæ such as radio-necrosis.

(*d*) We have not obtained satisfactory results from the association of radium with surgery.

II.—*Epithelioma ani.*

The anal canal is one of the regions in which the covering epithelium shows a transition from stratified squamous epithelium on the one hand to columnar epithelium of the intestinal type on the other. Correspondingly, two distinct species of malignant growth are found.

(1) The epitheliomata of the intestinal type occur less frequently. Their radio-resistance is of the same order and subject to the same variations as those which have been discussed in the section on carcinoma of the rectum.

But these tumours are much more accessible that those found in the rectum, and it is often possible to treat them by interstitial curietherapy accurately. In cases in which the disease is still localized to the anus and the peri-anal infiltration is minimal, this treatment is often followed by success. The high doses that are necessary, however, render the risk of subsequent radio-necroses serious.

In operable cases, an unsuccessful radiation treatment may still be followed by an amputation of the rectum and anus.

Cases which the extension of the disease has rendered inoperable are not likely to be cured by curietherapy and it is necessary to be content with a palliative result.

(2) Squamous-celled epitheliomata of the anus are more common. Any one of the large number of varieties of squamous epithelioma of the epidermal type may be met with. The most frequent type is the variety showing a predomination of undifferentiated cells, which are situated at the periphery of the malignant lobules and cords. It is in this layer of undifferentiated cells that multiplication of the malignant cells occurs. Other tumours show this predomination of undifferentiated cells, but in addition the central cells show only a slight tendency to differentiate with horn formation and horn pearls. On occasions tumours are found in which no differentiation at all can be observed, the whole neoplastic tissue being composed of undifferentiated cells. All these varieties show a comparatively high radio-sensitivity and may be treated successfully with radium.

(3) At the Institute we are accustomed to treat the squamous epithelioma of the anus by an association of needling with surface radiation. A colostomy is made beforehand, except in the case of very small tumours.

(*a*) *The first stage* of the treatment proper is the implantation of the needles suitably placed to encircle the cutaneous portion of the growth. The needles extend into the peri-anal connective tissue and their length is in relation to the extension and depth of the growth. Each needle is held in place with a stitch to the skin.

The needles are loaded with radium or radon in small cellules 15 mm. long. A needle may contain up to six such cellules. The needles are left in place for about eight days and the dose varies from 0·5 to 1 millicurie of radon destroyed per cellule.

(b) *The second stage* was, until recently, the preparation of a wax moulage loaded with radium for the external radiation of the peri-anal region. The distance from skin to the radium was from 5 to 8 cm. and the surface varied according to the requirements of the case; 1 mm. platinum was employed as filtration. To prevent vagabond radiation the free surfaces of the moulage were covered with sheet lead, 5 mm. thick. Treatment was given daily in séances of several hours. This treatment was attended by several practical difficulties, such as the weight of the apparatus, the immobilization of radium and the somewhat insufficient protection.

We have therefore replaced this moulage by telecurietherapy, using an apparatus containing 2 grm. of radium, which is supported independently of the patient. The surface can be varied from 60 to 100 sq. cm. The distance, skin to radium, is 8 cm. The radiation surface is centred on the anus. The patient is treated daily with sittings of from one to three hours during a time of approximately three weeks.

The dose varies in accordance with the following factors: radiating surface, distance, total duration of treatment, and size of the dose given by needling. We employ a dose between 200 and 400 millicuries of radon destroyed for the telecurietherapy treatment.

Gradually the part played by the needling is being reduced. This is compensated by larger doses of telecurietherapy. Up to the present we have not employed telecurietherapy to the exclusion of the needling, but it is possible that in favourable cases we shall be able to dispense with the latter altogether. This will be an advantage, for the needling is accompanied by certain disadvantages, particularly with regard to the homogeneity of the irradiation.

In women we supplement the interstitial curietherapy by intravaginal treatment, using a moulded wax applicator.

We do not, in any circumstances, introduce apparatus loaded with radium into the anal canal.

(4) The anal epitheliomata are often accompanied by inguinal metastases, which may be bilateral. Up to the present we have treated these metastases by radical operation as far as possible, followed by a surface application of radium, or by telecurietherapy, if the histological examination has shown that the glands were, in fact, malignant.

A successful result is much more common in the treatment of anal epitheliomata than in that of rectal carcinomata. This observation has a considerable theoretical and didactic importance, for it is a good proof of the fact that the radio-sensitivity, which depends on the histological structure and physiological activity of the tumour, may be of determining importance in the treatment of cancer.

Summary

(1) Two types of rectal carcinoma are found—the classical differentiated adenocarcinoma, which is common, and a carcinoma containing undifferentiated cells, which is rare.

(2) The differentiated adenocarcinoma is very radio-resistant. Surgical measures are indicated. Radiotherapy is contra-indicated, except as palliative measure for pain in the terminal stages.

(3) The carcinomata containing undifferentiated cells are less radio-resistant and, should operation be impossible or be refused, then radiotherapy may be tried.

(4) Anal carcinomata of the intestinal type—adenocarcinoma—are rare. Anal epitheliomata of the skin type—squamous epithelioma—are more common.

(5) The treatment of anal adenocarcinomata corresponds in principle to that sketched for the rectal carcinomata, but the better accessibility will sometimes permit successful interstitial radium treatment.

(6) More commonly the tumours of the anus are found to be squamous-celled epithelio-mata. These are radio-sensitive, and are treated at the Institut du Radium at the present day with interstitial curietherapy followed by telecurietherapy with an apparatus charged with 2 grm. radium.

Mr. J. P. Lockhart-Mummery said that he completely agreed with Sir Charles Gordon-Watson. The important fact that had been demonstrated was that even bad and inoperable cases of cancer of the rectum could sometimes be cured by means of radium. At present the number of such cures was small, but he thought that with improved technique better results would be obtained in the future. He agreed that only in exceptional circumstances should radium treatment take the place of operation, but he considered that in the case of epithelioma of the anal region it afforded a better chance of cure than operation, and should be used in preference to it. He had demonstrated cases showing that the tumour could be made to disappear without damage to the sphincter muscles or the necessity for a colostomy.

He had found that the greatest difficulty was to estimate the dose of radium correctly. Also in too many cases there was a late radium reaction which caused a great deal of trouble. This secondary reaction, when it occurred, took place from six to nine months after treatment and seemed to be more frequent in elderly patients. It was supposed to be due to an obliterative arteritis, but he knew of no way of preventing it.

He doubted if adenocarcinoma was any less radio-sensitive than squamous-celled cancer. He believed that the difference in the results between the treatment of adenocarcinoma of the rectum and epithelioma of the skin was due, in the main, to the technical difficulty of access in adenocarcinoma as compared with the access which could be obtained with surface tumours. In his experience growths in the rectum, when good access was obtainable, responded very well to radium treatment. It was his own practice to scrape away as much as possible of the growth with a curette before inserting the radium and to place the needles or seeds under and around the tumour rather than in it.

CASES

(I) Ada S., aged 72.

Epithelioma of left buttock. The tumour was a little larger than a shilling and was situated just behind and to the left side of the anal opening.

January 16, 1933 : Radium needles inserted round and beneath the growth. The total amount of radium used was equivalent to 12·5 mgm. and the total number of mgm. hours 2,062.

A piece of the tumour removed for examination showed typical squamous-celled epithelioma. There were no affected glands.

Three and a half weeks later the tumour had practically disappeared. On March 4, 1933, healing was complete and there was no sign of growth.

(II) J. A., aged 59

Epithelioma of anus.—The tumour was rather smaller than a shilling, spread out on the skin in front and on to the left side of the anus, and passing up the anal canal for ¼ in. No affected glands.

A portion removed for examination showed squamous-celled epithelioma.

April 6, 1932, an equivalent of 9 mgm. of radium was inserted (total mgm. hours 882). A week after the insertion of the radium the ulcer looked like a burn and the hard edges had become soft ; one week later it was rapidly healing and was quite soft. When the patient left hospital, on April 25, three weeks later, it had entirely disappeared. There was very little local reaction.

When the patient was examined again on January 11, 1933, there was no sign of recurrence.

(III) Mrs. N., aged 59.

Epithelioma between the rectum and vulva on the left side, mainly involving the skin of the perineum and buttock. The original tumour was about 2 cm. in diameter. Biopsy showed typical epithelioma. There were affected glands in the groins.

September 18, 1933, nine radium needles (the equivalent of 11 mgm. of radium), were inserted and kept in for 1,848 mgm. hours. Three weeks later three 2-mc. radon seeds were inserted into the glands in the left groin.

In March 1934, patient readmitted with a slight recurrence in the anterior part of the scar; Four 2-mc. radon seeds were inserted. A radium burn developed afterwards, this lasted for about nine months and then healed. At the present time the patient appears to be well. No glands are palpable in the groins and the wound has scarred over, with no signs of growth.

Mr. Stanford Cade : No better evidence as to the possible usefulness of radium in the treatment of rectal cancer could have been brought forward than the patients shown by Sir Charles Gordon-Watson, all clinically free from disease and in normal health for periods of five to seven years after treatment. These cases show that it is possible to obtain retrogression of the disease by interstitial radium treatment. Admittedly the successful cases are small in number but there is no justification for saying as some have done, that radium has no place in the treatment of inoperable carcinoma of the rectum. Operable cases must be submitted to operation, which remains, so far, the first line of treatment. On the other hand epitheliomata of the anus, which are skin lesions and radio-sensitive, are eminently suitable for radiation ; the results are good if the technique is correct, the dosage adequate, and the lesion early.

Colostomy should be carried out in all cases. To avoid colostomy is not the primary object of irradiation, and there is no doubt that the risks of radium treatment are definitely diminished by a preliminary colostomy. It is possible, but not at all advantageous, to avoid colostomy. It is essential in this group of cases to administer pure gamma-therapy. All primary beta rays should be screened ; as much as possible of the secondary beta rays should be eliminated. The time factor is of equal importance to filtration, and it is the experience of most workers that rectal cancer requires prolonged irradiation if success is to be obtained.

As regards method of irradiation, the complicated methods advocated a few years ago have been abandoned in favour of much simpler and safer procedures.

The cases are divided into two groups, those in the ampulla and those at the pelvi-rectal junction. In the former, irradiation consists of a simultaneous intra-rectal and peri-rectal insertion of radium in such a manner that the tumour is submitted to the effects of radium from the periphery from a series of weak foci of irradiation and from the lumen of the bowel from a relatively high source of radiation.

Peri-rectal irradiation.—High lithotomy position is necessary. The coccyx is removed, but otherwise no surgical exposure is necessary. The needles are inserted by puncturing the skin and guiding their position by a finger in the rectum. In the male a metal sound is introduced in the urethra and the prostate and urethra brought down as near the perineum as possible ; in the female the anterior group of needles are placed through the vagina.

Intra-rectal radium.—Three or four tubes of 10 mgm. each are used. They are inserted in a rubber tube of 1 mm. thickness and a knot is tied in between each tube. The total length of the tube is about 10 inches. This is inserted with the aid of a proctoscope into the lumen of the growth. The rectum is tightly plugged, so as to keep the tube in position ; the end of the rubber tube is sutured to the anus in two places.

Both sets of radium are left in situ from seven to ten days. On removal of the radium the growth is seen to be flatter and the surface covered with a film of white

fibrin.   The immediate results are encouraging, and the above irradiation appears to be a step in the right direction.   It is far too early to express an opinion on the ultimate results.

In the uppermost part of the rectum this method is not applicable, and the insertion of seeds is used as a second best.   For this purpose a special sigmoidoscope is required, so that the seeds can be introduced under vision without deflating the bowel.

From 1928 to 1934 I have treated 69 cases, all inoperable ; 29 patients are still alive ; of five treated in 1928 only one is alive, but eight are alive out of 17 treated in 1929 ; some however are not free from disease.

Mr. W. B. Gabriel urged that operable growths should be treated radically. He had an idea that in certain border-line cases which had been treated with radium, if a laparotomy had been performed and a careful examination made from above, it might have been established that they were operable.   A very large number of frankly inoperable cases had secondaries in the omentum or liver, and he did not see how any sort of radium treatment would help them.   There were, however, a few cases which might be improved, and a very few which might be cured, by radium.

Dr. Cuthbert Dukes : Although the proportion of cases of cancer of the rectum cured by radium is not high, it is most important that we should keep on reminding ourselves that some cases have been definitely cured.   We have before us living witnesses of this fact, and it would be an unpardonable mistake if we allowed it to be forgotten.   In a further discussion on this question, to be held perhaps in fifty or one hundred years' time, credit will be accorded to Sir Charles Gordon-Watson, not so much on account of the absolute number of patients his methods of radium treatment has cured, as because he has definitely established the fact that radium can be successful if used correctly in suitable cases.   It is one of the tasks of the immediate future to distinguish the types of cancer for which radium is effective and exactly how the radium must be used.
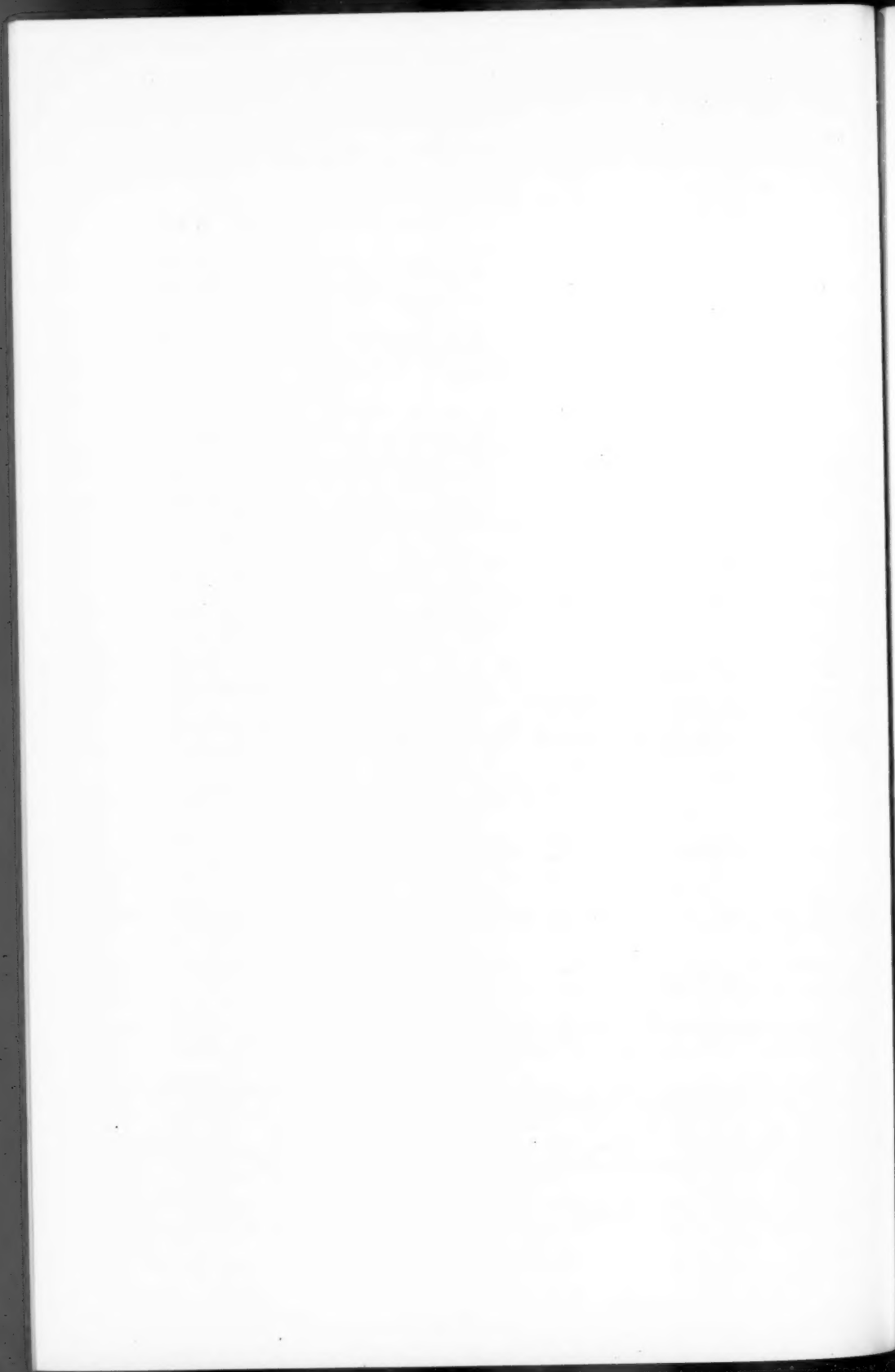
Section of Therapeutics and Pharmacology

President—J. H. BURN, M.D.

The Manifold Effects of Testicular Hormones (as Extracted from Human Urine or Synthetically Prepared) and of Œstrone on the Male, as Judged by Experiments on Rats

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[ABSTRACT]

THE effects of castration and of injections of testicular hormones extracted from human urine (purified preparations) or prepared synthetically by Professor Ruzicka (crystalline hormone Androstero), and of œstrone (crystalline hormone), administered separately or simultaneously, were studied on normal and castrated male rats. A preliminary note on the effect of these injections on female rats was also given.

The significance and the satisfactory accuracy of the " method of weights " was emphasized and demonstrated, especially in the study of the effects of mild physiological, stimulating or depressing factors normally present in the organism.

Castration in male rats produces the following definite changes : Striking atrophy of the sex organs (prostate, seminal vesicles, penis and preputial glands), slight atrophy of the thyroid and, about seventy days after castration, of the liver and kidneys ; delay in involution of the thymus and hypertrophy of the adrenals and the hypophysis. In addition most animals show an increase in fat deposition and a decrease in body-weight, or in gain of body-weight, of small and varying degree. It is probable that the very slight decrease in the weight of the heart, observed in most castrated rats, was also specific.

While, histologically, the sexual organs, thyroid, thymus, adrenals, and hypophysis of castrated rats showed the typical changes described, in spite of changes in weight no definite microscopic changes could be found in the liver.

Testicular hormone prepared synthetically by Professor Ruzicka, was assayed, one rat unit being found to be contained in from 160 to 180 γ. The other properties of this synthetic testicular hormone were compared with the effects of the testicular hormone preparations extracted from urine, all of which showed a similar, if not identical, action on both normal and castrated rats.

The gain in body-weight and appetite in castrated animals was favourably influenced by injections of testicular hormone, and slightly decreased by œstrone injections. These effects of œstrone were also shown by normal rats, while the injection of testicular hormone into normal rats produced no marked influence in either direction.

The weight of the testes of normal rats was slightly depressed by injections of testicular hormone or of œstrone, especially in young animals, in which microscopically the development of the seminiferous tissue was seen to be delayed.

While in the case of normal rats testicular hormone had little influence on the other organs, œstrone in large doses produced the following effects : A considerable decrease in the weight of the prostate and seminal vesicles, in which microscopically it could be seen that the amount of secretion was decreased and that the fibrous tissue in the seminal vesicles seemed to be slightly increased ; the adrenals, both in weight and microscopically, presented a hypertrophy typical of those of castrated

rats ; the liver cells were vacuolated and in most cases the hypophysis was hypertrophied.

There was no rejuvenating effect on old normal male rats with the doses of synthetic testicular hormone which were used.

In the organs of castrated animals testicular hormone caused a return towards normal of the changes produced by castration, increasing the weight of the prostate and of the seminal vesicles, the penis and the preputial glands and, in most animals, the thyroid and the liver ; the speed of involution of the thymus was increased and the hypertrophy of the adrenals decreased, or returned to normal (synthetic hormone). These changes towards normal were corroborated by histological investigation. The injections also increased the weights of the kidneys and the heart (this latter more marked with synthetic hormone).

Injections of œstrone into castrated rats produced the following changes in the organs : An increase in the weight of the seminal vesicles and a very small increase in the weight of the prostate, in which glands histological investigation showed an increase in the smooth muscle ; abnormal development of the fibrous tissue and metaplastic changes in the epithelium of the coagulating gland and of the dorsal part of the prostate ; an increase in the already existent hypertrophy of the hypophysis and vacuolization of the liver cells.

Addition of œstrone to testicular hormone injections was followed by some increase in the effect of testicular hormone, chiefly on the seminal vesicles, while the effect typical of œstrone was shown in the liver cells and the change in weight of the hypophysis.

The pathological disturbance in the balance between œstrone and testicular hormone may be one of the causes of the hypertrophy of the prostate in elderly patients, since histologically there is no definite pathological change in the prostate of normal rats injected with œstrone, or in the prostate of castrated rats injected with testicular hormone simultaneously with œstrone, while considerable pathological changes are seen in the prostate of castrated rats injected with œstrone alone.

The results of experiments, both on castration and on injections of testicular hormone and of œstrone, show that these hormones are to be regarded not as sexual hormones only, but as hormones with manifold effects, other important functions and organs being influenced by them.

Microscopic Demonstration of Hypophyses of Rats, Normal, Castrated and after Injection of Œstrone or Synthetic Testicular Hormone

By A. C. CROOKE, M.B., B.Ch., and V. KORENCHEVSKY, M.D.

[ABSTRACT]

A HISTOLOGICAL examination was made of the pituitary glands of 60 rats— 51 males, of which 20 were castrated, and 9 ovariectomized females. Each litter, normal or operated, was divided into a control group and a group injected with œstrone (20 to 180 I.U. per day), or synthetic testicular hormone ($0 \cdot 9$ to $1 \cdot 8$ mgm. per day). Sections of pituitary glands were stained by Ehrlich's hæmatoxylin, followed by a modification of Mallory's acid fuchsin aniline blue.

(1) The histological changes produced in the pituitary glands by castration were in agreement with the most recent reports in the literature.

In the normal gland there were remarkably few basophil cells, whereas in the castrated rat they were larger and greatly increased in number. In addition the majority of these basophil cells contain one or more large vacuoles which in extreme cases form signet ring cells, compressing the nucleus against the cell membrane. The

large vacuole in the "castration cell" was seen to contain a network of fine blue fibrils so that it appeared to be made up of a great number of small vacuoles.

(2) The injection of œstrone, even in big doses of 180 I.U., into normal male rats had no influence on the histological appearance of their hypophyses in spite of the increased weight of these glands.

(3) After œstrone injection into castrated male rats there was a return towards the normal histological appearance in the pituitary glands; the basophil cells were still large and greatly increased in number, but the "castration cells" were almost absent.

In none of these glands could we recognize any changes in the acidophil or chromophobe cells.

(4) In ovariectomized females after large doses (180 I.U.) of œstrone, there was a return towards normal appearance in the pituitary glands, although it was less pronounced than in treated castrated males. No changes were noticed after injection of small doses (20 I.U.) of œstrone in ovariectomized females.

(5) No histological effect was produced in the pituitary glands by injection of synthetic testicular hormone (in the doses used) into castrated male rats.

[*March* 12, 1935]

DISCUSSION ON THE TREATMENT OF ANGINA PECTORIS

Dr. T. F. Cotton: The treatment of angina is based on an orthodox, and what I believe to be a rational, conception of the pathology of this malady. Many hypotheses advanced in the past to explain the mechanism of anginal pain have been abandoned, and have been replaced by the conception that the cause of the pain is a problem of disordered coronary circulation and its consequences. The evidence which is now available shows that the origin of the pain is in the heart muscle, and is produced by a chemical stimulus which has accumulated in the tissues of the heart as a result of a reduced blood-flow in the coronary vessels. The contracting heart muscles, under conditions of insufficient blood-supply, are responsible for the pain; when the circulation is restored the heart muscle is supplied with sufficient aerated blood, the pain stimulus is no longer active, and a recovery takes place. There is good experimental evidence to support the hypothesis that the pain of angina is due to a relative myocardial ischæmia. The observations of Lewis and his co-workers on intermittent claudication support this theory of anginal pain. They have demonstrated beyond reasonable doubt that essentially the cause of the pain, its character and type, are the same in the two conditions. When the arteries of a limb are diseased, pain can be provoked by exercise more easily than in a limb with healthy arteries. A similar process takes place in heart muscle. In acute obstruction of a coronary vessel pain develops rapidly, it is continuous, and can be linked with an inadequate blood-supply to the heart muscle; the area involved is in a state of circulatory arrest.

Lewis has clearly shown that in angina and intermittent claudication the relationship between pain and vascular changes is the same. He has proved that the pain of angina may be independent of a rise in blood-pressure, and can, in certain circumstances, be closely linked with an increase in the pulse-rate; that the pain is more easily provoked in cold weather and on a windy day, because the patient walks faster and makes a greater effort. The pain after a heavy meal is not due to a loaded stomach, but is caused by an increase in the blood-flow in the abdominal vessels as an aid in the process of digestion. It is clear, from the investigations in his laboratory, that the anæmic patient is a potential anginal subject; that pain,

anginal in character, can be induced by exercise because the supply of oxygen in the blood is not sufficient to meet the demands of contracting heart muscle. The problem of explaining the mechanism of anginal pain has been attacked by provoking and relieving the pain under controlled conditions ; by this method of procedure the factors determining the symptomatic reaction of the patient have been accurately defined. We may accept the hypothesis that some chemical or physiochemical reaction takes place in the heart muscle deprived of its proper blood-supply, and that in consequence there accumulates in the tissues of the myocardium what has been described as a pain factor. With the circulation restored, the cause of the pain is no longer in action, and recovery takes place.

It must not be thought that the recent advance in our knowledge of this malady has come from experimental methods of investigation alone ; clinical observations have played a large part in consolidating our views regarding the causation of anginal pain. The coronary occlusion syndrome, as a distinct clinical entity, is a conspicuous example of accurate observations made at the bedside, which have proved of the greatest value in the treatment of a large group of anginal patients. Although a position of complete security of diagnosis has not yet been reached, we know enough about the mechanism of the production of angina to treat this malady in a rational way. We can recognize three types of angina, and treatment is based on their identification ; they are coronary thrombosis, spasmodic angina, and angina of effort.

It may be helpful in this discussion if I approach the problem of the treatment of angina in some of its broader aspects and confine my remarks to some extra-cardiac factors and the part they play in the anginal syndrome. If it is true that the heart muscle is the seat of the pain and that the cause is a disturbed coronary circulation, it is also true that these circulatory events may be closely related to structural changes and functional disorders in other parts of the body.

The similarity of the symptoms of gall-bladder disease and other disorders of the digestive tract, to those of angina, and particularly of coronary thrombosis, is one of the real difficulties with which we are faced in the diagnosis and treatment of coronary disease. Pain, a presenting symptom, is a distinctive feature of the clinical picture in these cases, and if the diagnosis is to rest on a secure basis, the cause must be known, the mechanism explained, and the results of treatment established. When the gall-bladder is the known seat of disease and the pain is typical of gall-stone colic, without going beyond the facts, the requirements for diagnosis and treatment are fulfilled. When pain resembling an anginal seizure occurs in a patient with gross structural disease of the heart, and there is clinical and X-ray evidence of gall-bladder disease, unless the pathological relation-ship between the gall-bladder and the heart muscle can be defined, the diagnosis of angina pectoris may remain obscure. The diagnosis is more uncertain when characteristic anginal pain develops in a patient with gall-bladder disease and an apparently healthy heart, for we know how frequently anginal subjects present no signs of structural disease of the cardiovascular system. If, as often happens after the removal of the gall-bladder in this type of case, the anginal pain does not recur, and health is restored, is it reasonable to assert that the pain due to a reduced blood-flow in the coronary vessels, from vasomotor or toxic influences, can be directly or indirectly related to the diseased gall-bladder? Is there justification for assuming that anginal pain in these circumstances must be related to a coronary circulatory defect? A third question, it may be thought, requires an answer—is the pain a gall-bladder pain throughout the attack, and not linked with any disorder of the coronary circulation? If one takes the view that the gall-bladder may be the cause of the anginal pain, there is the supporting evidence of patients with angina who have no recurrence of pain after the gall-bladder has been removed. I have records of 27 cases with anginal pain and gall-bladder disease. In 10 cases operated upon, gall-stones were found in nine, and in all but one there was recovery from the chest pain ;

in one case effort angina was less easily provoked. In five other cases gall-stones were
visualized, and two of these had less anginal pain as a result of a cholecystitis régime.
In 12 cases the diagnosis of gall-bladder disease was made on the clinical history
without an X-ray examination. The evidence on which to base a certain diagnosis
of gall-bladder disease is lacking, and for this reason I do not wish to emphasize the
gall-bladder element in the anginal syndrome in these 12 cases until further
information is obtained. There was slight enlargement of the heart in three of
the 15 cases, and there were electrocardiographic changes in three cases with
suggestive, but not distinctive, coronary signs. It does not seem to me to be too
speculative to accept the view that the causes of anginal pain can be controlled by
a cholecystectomy. I believe that gall-bladder disease and anginal pain may be
pathogenetically correlated, and are not separate phenomena. If this theory is
acceptable it is fair to assume that structural disease in other abdominal viscera
may present a similar relationship. Renal colic, prostatic obstruction, and
duodenal ulcer are maladies not infrequently associated with pain of anginal
character, which does not recur after operation. Anginal pain may be less easily
provoked after recovery from a functional disorder of the gastro-intestinal tract.
I have observed much less anginal pain in a patient after sprue, without anæmia,
has been recognized and treated.

If we are led, from clinical observations, to conclude that anginal pain may
develop from a diseased gall-bladder, this conclusion would be strengthened if
evidence could be supplied to show how the circulatory changes, which are
responsible for the pain, arise.

The stimulus must be mechanical, chemical, or nervous. It is unlikely, for
anatomical reasons, that a mechanical factor, except by releasing a nervous
mechanism, can produce a reduced blood-flow in the coronary vessels. We have
evidence that a chemical stimulus can disturb the action of the heart; it is well
known that auricular fibrillation may be of toxic origin. We are all aware of the
close relationship between an infection and coronary disease. Sepsis may be held
responsible for pathological changes in the coronary vessels.

Evidence in favour of the view that nervous influences alone may affect the
vasomotor tone of the coronary arteries is not lacking. A generalized vaso-
constriction, including the coronary vessels, may cause an anginal seizure. A painful,
or some other, stimulus from a diseased gall-bladder may produce, reflexly, a
vasoconstriction, and as a sequel, myocardial ischæmia and anginal pain. It is
difficult to understand how the release of a mechanism of this kind can be the cause
of angina when the coronary vessels are healthy, for it is only in exceptional cases
that structural changes in the gall-bladder can provoke an anginal attack. It is
probable that these patients are potential anginal subjects with unrecognized
coronary changes. The same argument may be applied in discussing angina in
relation to other disorders of structure and function of the gastro-intestinal tract.

Clinical observations have demonstrated the value of a thyroidectomy in the
treatment of angina. Good results from the complete removal of a healthy thyroid
gland have been recorded by Levine and others. Post-operative myxœdema seems
to have been effective in preventing anginal attacks or lessening their frequency. It
is known that intramuscular injection of adrenalin will provoke an anginal seizure
in an anginal subject. Levine has shown that when adrenalin was injected after
operation there was no complaint of pain. He concludes from observation on five
cases that control of the anginal pain is not due to a lowering of the basal metabolic
rate, or to change in the rate of the blood-flow, but can be attributed to an altered
reaction of the cardiovascular system to adrenalin. When we come to consider
anginal patients with thyrotoxicosis, there can be no doubt that a thyroidectomy is
indicated. One would be justified in advising a total thyroidectomy, as in the
non-toxic cases, and not a subtotal thyroidectomy.

I should like to refer briefly to angina in its relation to anæmia. In these patients the oxygen-carrying power of the blood is reduced, the heart is deprived of its proper blood-supply, and the cardiac muscle is virtually in a state of relative myocardial ischæmia. An effort angina may be provoked by physical effort, and recovery takes place when the anæmia has been treated. In severe anæmia anginal pain is not an uncommon complaint. Pickering and Wayne, from observations on patients with a hæmoglobin of 50% or less, conclude that effort angina in these cases is mainly due to a reduced oxygen-carrying power of the blood; that a fall in the mean blood-pressure or increased blood-flow are not essential features in the production of pain. Anginal pain is more likely to occur when the coronary arteries are diseased, and recovery after treatment with iron or liver may be expected when the coronary arteries are healthy. Improvement may be observed when there is narrowing of these vessels. These are important observations, and support the theory that the seat of the pain is in the tissues of the contracting heart muscle.

I would like to make one or two observations about diabetes in its relation to angina. The middle-aged and elderly diabetic with anginal pain has arterial degeneration which may be due to other causes than diabetes. There can be little doubt that nutritional changes in the tissues of the body can be linked with the two phenomena arteriosclerosis and hyperglycæmia. In the heart muscle there is much glycogen; in diabetes it is reasonable to assume that the supply of glycogen is less than is required for the functional efficiency of the myocardium. Insulin would seem to be indicated to restore the carbohydrate balance and in this way aid in the nutrition of the heart muscle deprived of its proper blood-supply from coronary disease. There is easy justification for prescribing insulin for anginal patients with hyperglycæmia as a remedial measure in the treatment of anginal attacks.

Dr. Crighton Bramwell : *Benign cardiac pain.*—I propose to confine my remarks on the treatment of cardiac pain to certain general considerations, and to leave to Dr. Hoyle the important question of drug therapy. To clear the ground I must first refer to the condition known as "false angina"; and in so doing, I would strongly advocate the abolition of this terminology. I dislike intensely the diagnosis "false angina," because the word "angina," however qualified, suggests to the lay mind the idea of sudden death, and no one has ever died of false angina. It has been truly said that it is the diagnosis and not the angina which is false.

(*a*) *Anxiety neurosis*: If one excludes dyspeptic symptoms such as heartburn, the most common causes of pain simulating angina are two in number. Of these the first is anxiety neurosis. The neurotic type of pain is the result of suggestion. It is most common in people whose relatives or intimate friends have suffered from angina, and can generally be recognized by the fact that it fails to reproduce accurately the clinical picture of organic disease. It differs from angina in its age-incidence, being common before the age of 40, and in the fact that it affects women more frequently than men. The treatment of this type of pain is purely psychological. It consists of convincing the patient that there is no disease of the heart, and therefore no cause for anxiety. At the same time it is desirable to explain to her the way in which her symptoms have arisen, and to impress upon her the fact that, since she now realizes that her symptoms are of no material significance, they will gradually fade out of her conscious life.

(*b*) *Heartache.*—The second common cause of præcordial pain is general nervous exhaustion. The title "heartache" may appropriately be applied to this type of pain on account of its nagging and persistent character. Like the pain of anxiety-neurosis, it is much commoner in women than men. The pain is usually referred to the left sub-mammary region, and not infrequently radiates through to the back or passes down the left arm. The time relations of heartache serve to differentiate it

from angina in that the pain occurs not during, but *after*, exertion. It is usually at its worst in the late afternoon and evening, when the patient is tired. It often persists after she has gone to bed. The pain is only one, though it may be the outstanding one, of a large and varied group of symptoms, including nervousness, palpitation, flushings, faintness, fatigue, præcordial hyperæsthesia, and irregular sighing respiration. The multiplicity of the symptoms, all of which are attributable to nervous exhaustion, clinch the diagnosis, and differentiate the condition from angina, in which these other symptoms are absent.

The treatment of this type of pain consists of attention to the general health, with adequate rest and relaxation. Some patients derive benefit from sedative drugs. The tendency to relapse is characteristic of this condition, as one might expect in view of the nervous "make-up" of the patient. The most important difference between angina and heartache, however, is that the latter does not affect the expectation of life.

(2) *Angina.*—(a) *Progressive coronary stenosis* : We now believe that angina is always due to a deficient blood-supply to the heart muscle—myocardial ischæmia. In recent years, the pain of cardiac infarction has been clearly differentiated from that of angina of effort, by the recognition of the clinical syndrome of coronary occlusion. I cannot help feeling that there is a danger of this differentiation being carried too far. The two conditions often overlap. There is, to my mind, no more grave omen in angina than a rapid diminution in the patient's tolerance for exercise. The man who three months ago could walk a quarter of a mile and is now pulled up by pain in twenty yards, is, it is true, at the moment suffering from angina of effort, but I regard that man as a candidate for coronary occlusion. This clinical history points to a steady diminution in calibre of the coronary arteries, and for that reason I would suggest for this transitional condition the name "progressive coronary stenosis." Let me not be misunderstood. The point which I wish to make is that, although acute coronary occlusion is a distinct clinical entity, and although we meet with cases of pure angina of effort where, over a period of years, the patient's tolerance for exercise shows little tendency to diminish, we also meet with cases in which the one condition is leading up to the other. In these, coronary occlusion is the natural sequel to angina of effort.

(b) *Acute coronary occlusion.*—For patients suffering from cardiac infarction in whom the pain is severe, morphia is the only drug which will bring relief, and it must be given freely. Apart from the relief of pain, the principal immediate indication for treatment is to tide the patient over certain danger periods, when serious complications threaten life.

Let me now consider what these complications are, and what means we can adopt to avert them. Coronary occlusion may cause sudden death. Such a fatality is probably the result of ventricular fibrillation. To prevent this complication we are at present powerless. Secondly, in all but the very mild cases, myocardial infarction is followed by profound shock, resulting from the sudden fall in blood-pressure. This complication may render the patient's condition critical for twenty-four or forty-eight hours. Its treatment is that of surgical shock. Thirdly, in those who survive the initial period of shock, the infarct constitutes a weak spot in the heart wall, which may give way, with rupture of the ventricle. To guard against this complication, which may occur at any time during the second or third week following an attack of coronary occlusion, absolute rest is essential.

Many of those who escape these immediate dangers develop heart failure with venous engórgement, while all are liable to die in a second attack, since the underlying pathological conditions which predispose to thrombosis are still present. Experimental work on animals suggests that arteriosclerosis is due to a disorder of cholesterin metabolism. Whether by dietetic or other measures it may be possible, in the future, to retard its development, is a subject too speculative to consider to-day.

(c) *Angina of effort.*—In this condition the patient is free from symptoms provided he is content to take life quietly, but as soon as he attempts to accelerate he is pulled up by pain. The coronary circulation is adequate for the requirements of the body at rest, but lacks the reserve necessary to meet the further demands made upon it when the heart has to increase its output.

From the point of view of treatment, I regard it as important to distinguish between the primary pathological factors responsible for the production of myocardial ischæmia, and the secondary or accessory factors which tend to aggravate the condition.

By the primary factors, I mean such conditions as coronary obstruction, coronary spasm, a low coronary blood-pressure (in patients with free aortic regurgitation) or a deficient oxygen-carrying capacity of the blood (in profound anæmia). With the exception of coronary obstruction due to structural lesions, these conditions may in varying degree be relieved by appropriate treatment. The structural lesion determines the basal irreducible disability, to which the patient must adapt his mode of life.

Of extraneous factors which add to the heart's embarrassment, a hyper-excitable nervous system is the most important. The typical anginal subject is by no means a neurotic, nevertheless the nervous make-up varies considerably in different patients. The nervous factor may be considered from three aspects. In the first place, the threshold of sensitivity to pain varies in different individuals. Other things being equal, the limitations imposed on the patient's activities are much greater in the hyper- than the hypo-sensitive subject. Secondly, in the irritable "nervy" type of individual, an anginal attack may be precipitated by a relatively trivial emotional disturbance, since the detonating mechanism which fires off an attack lies dangerously near the surface. Minor annoyances will, in him, suffice to produce an emotional storm adequate to provoke an anginal seizure; whereas, in the calm placid person a much more massive stimulus is required to bring on an attack. Thirdly, there is the element of anxiety. Angina is proverbially associated with sudden death. It is true that the fear of death is probably less potent now than it was before the war, for those who have so often seen death at close quarters realize that there is nothing to dread in death itself. Nevertheless they may still be loth to die because they will leave their dependents inadequately provided for. This anxiety factor, I believe, enters into every case of angina, and merits careful consideration and treatment.

We can do much to combat the nervous factor and thereby to reduce to a minimum the aggravation of the disease for which it is responsible. Bromides, luminal and other cerebral depressants will render the patient less liable to attacks, and the attacks less distressing when they do occur. Dr. Evans and Dr. Hoyle have shown that the cerebral depressants are the only group of drugs which, *when given in a routine manner*, reduce the frequency of attacks. The anxiety factor can only be treated effectively by a sympathetic and understanding physician, who can put himself in the patient's shoes and appreciate his difficulties.

Of the possible toxic factors, tobacco will serve as an example. Pure tobacco angina is, in my experience, rare, but the impairment of the tolerance for exercise produced by ex cessive smoking obviously reduces still further the already inadequate cardiac reserve of the patient on the verge of angina. The same is true of focal sepsis, and still more so of conditions like obesity. In obese subjects, apart from the impairment of exercise tolerance due to disordered metabolism, excessive weight itself imposes an increased burden on the damaged heart. Here we are dealing with a vicious circle. Obesity aggravates angina, angina limits exercise, and lack of exercise tends to increase obesity. To break this circle, diet, massage, and carefully graduated exercise are the principal weapons at our disposal.

This leads me to consider the whole problem of the rôle of exercise in the treatment of angina. That exercise is essential if one is to keep "in training" is a matter of common knowledge. By "training" I mean a high state of physical

fitness. The tolerance for exercise in the patient with angina is considerably lower than in the healthy subject. Even when he is in perfect training, he cannot do much. His threshold for pain is set at a permanently low level, but it is just as easy for him as for a normal healthy person to get out of training. His tolerance for exercise will then be still further reduced. Our object in treatment, therefore, should be to make sure that he is getting sufficient exercise to keep himself as fit as possible. This raises the question of how much exercise he should be allowed to take. When a boat's crew goes into training, very little is attempted during the first few weeks, and it is not until near the end of the training period that the full course is attempted. Similarly with our patient, we must feel our way very carefully, and regard the least sign of distress as an indication that we are trying to force the pace unduly. Starting with walking slowly for a short distance on the level, we may gradually increase both distance and pace, and, in favourable cases, may even work up to ascending gradients, provided that this can be accomplished without symptoms of distress.

Finally, having got our patient "into training" by graduated exercise, by the elimination of septic foci, and where necessary by a reduction in weight, we must endeavour to consolidate the gains which we have made. Here, certain rules may be laid down for his guidance. First, he must never attempt any exertion which he has found by experience brings on the pain. Secondly, he must set the pace himself and not attempt to keep up with others fitter than himself, and thirdly, he must lead a regular life and adapt his daily programme to the limitations of his damaged heart.

Second only in importance to exercise in the treatment of angina, is rest, both mental and physical. Here again we have difficult ground to tread. While an initial period of three or four weeks' complete rest in bed may be beneficial in a patient who, in spite of treatment, has been having frequent and severe attacks, an occasional day in bed may suffice for the less advanced case. It is, however, important to remember that mental anxiety may outweigh the physical benefit if, in those who cannot afford to be idle, the period of enforced absence from work be unduly prolonged. The psychological factor must always be taken into account.

A high blood-pressure adds greatly to the burden of the damaged heart in a patient with angina. This, however, I am inclined to regard as an aggravating, rather than a causal, factor in angina, for many patients with high blood-pressure never suffer from cardiac pain. We may regard the cardiac reserve as the credit balance of the cardiac budget. A high blood-pressure increases the working expenses, and thereby reduces the profits. In other words, it reduces the reserve available to meet the demands of increased physical exertion.

I have not referred to the surgical treatment of angina, because I regard it as still in the experimental stage. Complete thyroidectomy has been performed in a considerable number of cases with promising results. Operations such as sympath-ectomy serve to relieve the pain, but whether these procedures are justified appears to me doubtful for the reason that the pain in angina is a danger signal. It warns the patient when he is overtaxing his heart; and, if we relieve the pain without eradicating the cause of the disease, we may be removing an important safeguard which prevents him overtaxing his heart.

In conclusion, let me summarize my ideas regarding the therapeutic possibilities in the treatment of angina of effort in the form of a diagram (p. 80).

In the normal healthy subject (I), the cardiac reserve (A-E) far exceeds the basal resting requirements of the body (E-F). In the patient suffering from angina (II), on the other hand, the cardiac reserve (C-D) is greatly reduced. The reduction is in part attributable to impaired efficiency of the heart itself (A-C). This depends on various factors, of which the most important is insufficiency of the coronary circulation (A-B). Structural changes in the coronary arteries and in the

myocardium, are unfortunately of a permanent nature and therefore beyond the scope of therapeutic measures. As I have previously pointed out, however, the nervous factor is of great importance in determining not only the sensitivity to pain but also the liability to attacks. This can be, in part at least, controlled by cerebral depressants. Similarly we may eliminate toxic factors affecting the myocardium—such, for example, as tobacco and focal sepsis. By this means the
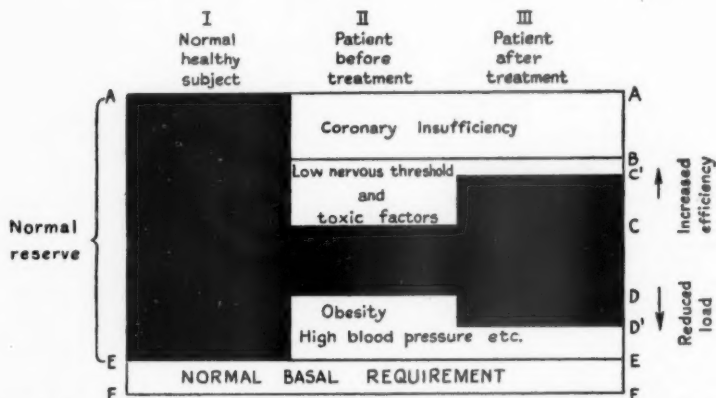
In this diagram the shaded area represents the cardiac reserve in I, the normal subject; II, the patient with angina before treatment; and III, the same patient after treatment.

In columns II and III the various factors which limit the cardiac reserve in the anginal patient are indicated. This limitation is due in part (D-E) to an increased basal requirement and an increased cardiac load, and in part (A-C) to impaired myocardial efficiency.

efficiency of the damaged heart can be increased from D-C to D-C′. We may likewise hope, by suitable treatment, to lighten to some extent the burden imposed upon the heart by such factors as obesity and high blood-pressure, thereby increasing the cardiac reserve from C-D to C-D′. That marks the limit of possible therapeutic achievement. When it has been attained the patient must be content to adapt his mode of life to his reduced exercise tolerance. C′-D′.

Briefly, our aim in treatment of such cases is to enable the heart to balance its budget by (1) Increasing its assets, (2) reducing its liabilities, and (3) adapting the patient's mode of life to the capacity of his damaged heart.

Dr. Clifford Hoyle: *The drug treatment.*—There has been no general agreement on the best routine treatment and scarcely any attempt to compare the relative values of the many drugs that have been recommended for angina of effort. Opinion has often been based upon a few and uncontrolled observations. Many of the older reports are valueless because of the confusion which then existed between angina of effort and coronary thrombosis. The separation of these two conditions has now led to a tardy recognition of a better outlook in angina of effort, with a revival of interest in its medicinal relief.

An investigation into the drug treatment of angina pectoris of effort was recently made in the Cardiac Department of the London Hospital, at the suggestion of Dr. John Parkinson, by Dr. W. Evans and myself.[1]

The investigation occupied about three years, and it was concerned with two main problems—to determine the comparative value of (1) drugs used in the

[1] Evans, W., and Hoyle, C., *Quart. Journ. Med.*, 1933, xxvi, 311. Id., *ib.*, 1934, xxvii, 105.

continuous treatment of angina pectoris, and (2) drugs used for the relief of individual attacks and for their immediate prevention. A systematic test was made of those medicinal remedies with any claim to be applied in treatment.

(1) *Continuous treatment.*—For the investigation on continuous treatment our series consisted of 90 patients. Syphilitic angina pectoris was excluded and all in this series had a negative Wassermann reaction. We believe that if reliable results are to be obtained and if confusion is to be avoided, the type of case selected for study should be clearly defined. All the patients in the series had angina pectoris of effort, characterized by recurrent attacks of substernal pain, which frequently spread across the chest, or through to the back, or radiated down one or both arms. Attacks were always determined by physical exertion. In some they occurred with emotion and in a few at night, but only where physical movement would bring on the pain just as readily. With these exceptions, attacks never occurred when the patients were at rest. They were always relieved by rest, and individual attacks varied from a minute up to one hour.

The most difficult problem in devising a plan of observation on treatment was to provide adequate control. With this object we adopted a scheme of treatment with placebo. Spontaneous variation in the severity of the pain, and occasionally the tendency to periods of relative freedom from attacks (remissions), had both to be considered, as well as other influences. As an initial control, one of two placebos [1] was prescribed for a fortnight at the first attendance. Patients were instructed to make personal records of each attack, noting the nature of the exertion which had induced the pain, and the duration of the several attacks when rest was the only treatment accorded. Later, between trial periods of active drugs, further control periods of two, four, or more weeks were introduced.

All patients were ambulatory ; they visited the clinic at fortnightly or monthly intervals. In order to avoid mental suggestion, the drugs were prescribed in a mixture form whenever possible, and a simple colouring agent added where necessary. The following drugs were tested : sodium nitrite, mannitol hexanitrate, erythrol tetranitrate, potassium iodide, luminal, chloral, morphine, papaverine, phenacetin, diuretin, calcium diuretin, euphyllin, belladonna, digitalis, lacarnol, and harmol. In deciding the dosage of individual drugs the full effects were sought for, and often doses greater than usual were prescribed. Care was taken in arranging the order in which these drugs were prescribed so as to avoid giving two important drugs over consecutive periods, and an intervening period was often allotted, during which the patient was given a placebo.

Results.—Apart from confusion with coronary thrombosis, the most important factor which has hindered progress in treatment has been disregard of the natural variations or, even remissions, which occur in the course of the disease. We believe that this explains why most remedies have appeared to produce good results on occasions. It has been known that remissions occur, but we have not found in the literature any exact statement as to their frequency and duration, when assessing the apparent good results obtained with certain drugs.

In 66 patients in our series who received placebo treatment only for a month or longer, 18 (27%) showed great improvement (i.e. a reduction of more than 50% in the number of attacks), and 7 (10·5%) showed moderate improvement (i.e. a reduction of less than 50% in the number of attacks). In the case of the active drugs, 9 of the 13 proved less efficacious than a placebo in reducing the frequency of the attacks (Table I, and diagram, p. 83). It is remarkable that placebo treatment gave better results than most of the active drugs, and appeared statistically to be the better form of treatment. Two factors probably contribute to this result. First, in the

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[1] Ŗ. Sodium bicarbonate 15 gr. Infusion of gentian to ½ fl. oz.
 Ŗ. Liquor carmine ½ min. Sodium bicarbonate 15 gr. Infusion of gentian to ½ fl. oz.

majority, a placebo was the first medicine to be given, so that mental suggestion may well have added bias in its favour. Secondly, placebo treatment was repeated more often than any single active drug, so that it coincided more frequently with a natural remission. Although placebo treatment may not actually deserve first place because of these fallacies, none of the active drugs claimed precedence over it. Chloral, morphine, papaverine and phenacetin had a trifling, though scarcely convincing, effect in controlling the group incidence and severity of attacks. If any drug had provided improvement greater than another and to a distinctive degree, we should have accepted this as evidence of its value in continuous treatment, but such improvement never occurred.

We were unable to convince ourselves that any drug tested is worthy even of trial for this purpose. Though not widely applicable, a drug might of course be effective in individual cases, and examples were sought for, but, with a few exceptions, were not found.

TABLE 1.[1]

Summarizing the Effects of Thirteen Drugs in the Continuous Treatment of Angina Pectoris Compared with the Effects of Control Treatment with Placebo

Drug	Number of patients	Great improvement (a)	Moderate improvement (b)	No improvement (c)	Worse (d)	Average number of attacks in each patient during average test period
		Patients arranged in groups according to response to treatment				
Placebo	66	18	7	22	19	29
Sodium nitrate	42	5	3	21	13	38
Placebo		12	5	11	14	30
Mannitol hexa-nitrate	21	2	1	13	5	41
Placebo		6	2	9	4	32
Erythrol tetra-nitrate	20	0	0	13	7	89
Placebo		7	1	8	4	57
Potassium iodide	47	13	5	20	9	22
Placebo		15	5	15	12	26
Luminal	59	8	14	30	7	22
Placebo		17	7	21	14	29
Chloral	56	19	13	15	9	19
Placebo		17	4	20	15	30
Morphine	48	16	11	15	6	21
Placebo		15	3	16	14	32
Papaverine	31	9	7	8	7	27
Placebo		9	3	11	8	29
Phenacetin	20	6	4	6	4	33
Placebo		7	1	6	6	26
Diuretin	53	10	5	30	8	24
Placebo		17	5	18	13	27
Euphyllin	37	7	3	16	11	36
Placebo		12	3	12	10	31
Belladonna	15	1	1	7	6	48
Placebo		4	2	5	4	35
Digitalis	19	3	1	8	7	34
Placebo		4	2	7	6	25

[1] The diagram on page 83, and the tables are reproduced from the *Quarterly Journal of Medicine* by kind permission of the Clarendon Press.
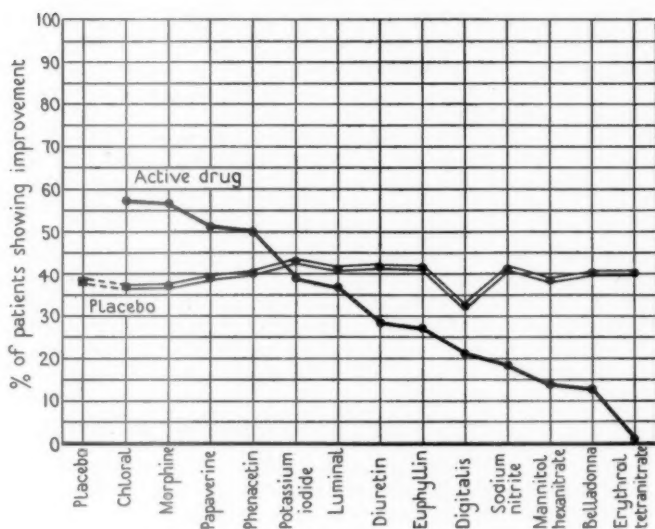
Diagram showing comparative improvement in patients with angina pectoris, from active drugs and placebo. Continuous line indicates improvement from active drugs. Double line indicates improvement from placebo in the same patients. Interrupted line indicates improvement in a standard series of patients treated with placebo.

(2) *Prevention and treatment of individual attacks.*—The previous negative results emphasized the need for a more general use of vasodilators in the management of individual attacks. Yet here too there is no agreement in the literature upon the comparative value of the various remedies.

For this part of our investigation the series was increased to 122 patients, and included 25 in whom the angina was due to syphilis.

The following drugs were tested : glyceryl trinitrate (trinitrin) in tablets, in the 1% alcoholic solution, in solution in oil, and also as proprietary preparations— natirose dragees (Nativelle), nitrolingual capsules (Pohl), and trinitrine caféinée pills (Dubois) ; amyl nitrite, sodium nitrite, brandy, chloroform, and carminatives.

It is first necessary to discuss two important questions which were found to decide largely the efficient action of glyceryl trinitrate tablets, namely their keeping properties on storage, and their absorption.

Assay of glyceryl trinitrate (trinitrin) tablets : Glyceryl trinitrate tablets with either chocolate or lactose base were used. They were made by the hospital dispensary or by a manufacturing firm, and tablets containing $\frac{1}{100}$ gr. (0·0006 grm.), $\frac{1}{50}$ gr. (0·0012 grm.), $\frac{1}{25}$ gr. (0·0024 grm.), or $\frac{1}{12}$ gr. (0·005 grm.) were used. We wished to know that the tablets as prepared in bulk actually contained the specified amount of the drug, and also whether they deteriorated when stored. Unequal distribution of the drug in the tablet mass during manufacture or loss of activity by chemical change or volatilization during storage might each render them inert. There was no evidence bearing upon either of these problems, because no method has been available for the assay of glyceryl trinitrate sufficiently sensitive to estimate accurately the minute quantity present in single tablets. It is true that occasional reference has been made to deterioration of the tablets, but this has been based only upon a therapeutic ineffectiveness.

Mr. C. H. Sykes, Ph.C.,[1] pharmacist to the hospital, devised a method of estimating small quantities of glyceryl trinitrate which can be trusted for the assay of single tablets. The method depends upon the colorimetric comparison of the blue colour produced by the action of diphenylamine on glyceryl trinitrate with a standard obtained by its action on potassium nitrate.

Assay showed that there was little variation in the strength of the tablets taken from batches freshly prepared and stored in screw-capped bottles or corked containers. All tablets manufactured in bulk which were examined contained between 80% and 100% of the estimated amount of glyceryl trinitrate, so that there is no appreciable error involved in the method of manufacture. There was, however, considerable variation in the strength of the tablets taken from constantly opened bottles after storage for six weeks or longer; a proportion of the tablets contained only 70% of their supposed content of glyceryl trinitrate. The tablets deteriorated markedly when they were stored for a long period, especially if they were in open containers. One batch, after storage for eight months in an open container at room temperature, contained only 30% to 70% of the correct amount of glyceryl trinitrate in each tablet, and only one out of six examined contained more than 50% of the proper dose. The tablets also deteriorated markedly when exposed to heat.

Absorption of glyceryl trinitrate (trinitrin).—The second factor which affects the action of glyceryl trinitrate relates to its absorption. Difference of opinion on the value of glyceryl trinitrate has led to doubt whether the drug is absorbed effectively from the stomach. Janeway[2] was the first to emphasize the importance of correct administration. He insisted that tablets of the drug should be taken on the tongue and not swallowed, because absorption from the mouth was more rapid than from the stomach, though he did not give supporting evidence. In 1923, Grossman and Sandor[3] reviewed the therapeutic action of glyceryl trinitrate, and pointed out that although its prompt effect as a vasodilator was well established, there was no unanimity regarding the best method of administration or the most suitable dose. They compared the effects of an alcoholic solution of the drug upon the pulse and blood-pressure, when absorbed from the mouth and when given by a stomach or duodenal tube. The method of administration decided the extent to which tachycardia and fall in blood-pressure occurred. These effects were produced quickly when absorption took place in the mouth; they were much less evident and delayed when the drug was swallowed, and were almost absent when the drug was introduced directly into the stomach or duodenum. The same differences were observed with the tablets. Soft tablets which dissolved readily in the mouth acted much more effectively than those which were swallowed; the latter had an uncertain effect or none at all. They did not find any essential difference in the action of an alcoholic solution and the tablets. The deciding factor in the rapidity and extent of the action of the drug was the time allowed for absorption from the buccal mucous membrane. Although previous clinical experience had already suggested the practical importance of this detail of administration, it appears to have received no further attention in the literature. We were able to confirm their results completely.[4]

The practical importance of these results is that the anginal patient must chew glyceryl trinitrate tablets thoroughly to ensure rapid therapeutic action from immediate absorption of the drug from the mouth. If the tablets are swallowed whole, or broken in the mouth and then swallowed quickly, they are of slight or no value in treatment.

1 Sykes, C. H., *Pharmaceut. Journ.*, Lond., 1933, cxxxi, 267.
2 Janeway, T. C., *Trans. XVIIth Internat. Congress Med. London*, 1913, Sect. V, Part I, 1.
3 Grossman, M., and Sandor J., *Klin. Wchnschr.*, Berlin, 1923, ii, 1833.
4 Evans, W., and Hoyle, C., *Quart. Journ. Med.*, 1934, xxvii, 105.

The scheme of therapeutic observations was similar to that already used in the investigations upon continuous treatment. While attending the department each patient made personal records of every attack, and details were noted of the severity and duration of attacks and the nature of the exercise which had induced pain. Particular attention was directed to the duration of the attacks when rest was the only treatment. This standard was subsequently used when comparing the effects of the various remedies in the same individual. The effectiveness of each drug in preventing the onset of an expected attack was then studied similarly. Patients had to record the prophylactic effect of a drug when taken immediately before an exercise which habitually induced pain, and to compare their freedom from pain, when walking measured distances, both without and with the aid of a drug. These were supplemented by our own observations in a few particular patients. The results are again discussed in four groups, indicating the clinical response as shown by a decrease in the number of attacks when compared with control observations during which no drug was taken to prevent pain.

Results.—There is general agreement that vasodilators, and especially nitrates, are the best means of relieving individual anginal attacks. The literature shows that choice of various methods of administration is not based upon exact knowledge of their comparative values. Valuable data were collected by several observers some fifty years ago, but usually they related only to a particular drug tried in a few patients, and some of these were the subjects of coronary thrombosis.

In deciding the comparative value of vasodilators, not only has the extent to which they relieve individual attacks to be considered, but also their power to prevent pain, and their freedom from disagreeable effects. In addition, the keeping properties, the readiness for use, and the price of the drug have all to be considered.

We found that glyceryl trinitrate in tablet form was by far the best remedy on all counts, provided that it was absorbed from the mouth (Tables II and III). The tablets rarely fail to relieve attacks effectively when they are used correctly; 86%

TABLE II.

Summarizing the Effects of Drugs Tried in the Immediate Treatment of Attacks of Angina Pectoris (Angina of Effort). Numerals in Brackets Indicate Percentages

Drugs	Number of patients	Great relief (a)	Moderate relief (b)	No relief (c)	Worse (d)	Marked	Slight	None
Tablets	122	105 (86)	13 (11)	4 (3)	—	2 (1·5)	28 (23)	92 (75·5)
The 1 per cent. liquor	24	15 (62·5)	5 (20·5)	4 (17)	—	1 (4)	7 (29)	16 (67)
Oily solution	26	7 (27)	10 (38·5)	9 (34·5)	—	3 (11·5)	9 (34·5)	14 (54)
Natirose dragees (Nativelle)	42	22 (52·5)	19 (45)	1 (2·5)	—	1 (2·5)	12 (28·5)	29 (69)
Nitrolingual capsules (Pohl)	27	5 (18)	11 (41)	11 (41)	—	—	5 (18·5)	22 (81·5)
Trinitrine caféinée (Dubois)	22	11 (50)	7 (32)	4 (18)	—	1 (4·5)	3 (13·5)	18 (82)
Amyl nitrite	63	27 (43)	23 (36·5)	10 (16)	3 (4·5)	48 (76)	12 (19)	3 (5)
Sodium nitrite	29	8 (27·5)	13 (45)	7 (24)	1 (3·5)	2 (7)	14 (48)	13 (45)
Brandy	16	3 (19)	5 (31)	7 (44)	1 (6)	—	2 (12·5)	14 (87·5)
Chloroform	16	5 (31)	6 (38)	4 (25)	1 (6)	10 (62)	3 (19)	3 (19)
Carminatives	12	3 (25)	3 (25)	6 (50)	—	2 (17)	2 (17)	8 (66)

(The first six drugs are grouped under the bracket labelled *Glyceryl trinitrate*.)

TABLE III.

Summarizing the Effects of Drugs Tried in the Immediate Prevention of Attacks of Angina Pectoris.
Numerals in Brackets Indicate Percentages

Drugs		Number of patients	Patients arranged in groups according to response to treatment		
			Great benefit (a)	Moderate benefit (b)	No benefit (c)
Glyceryl trinitrate	Tablets	72	61 (84·5)	9 (12·5)	2 (3)
	The 1 per cent. liquor	18	8 (44·5)	3 (16·5)	7 (39)
	Oily solution	19	4 (21)	3 (16)	12 (63)
	Natirose dragees (Nativelle)	21	9 (43)	7 (33)	5 (24)
	Nitrolingual capsules (Pohl)	22	3 (14)	6 (27)	13 (59)
	Trinitrine caféinée (Dubois)	17	7 (41)	6 (35·5)	4 (23·5)
Sodium nitrite		30	11 (36·5)	6 (20)	13 (43·5)
Amyl nitrite		63	—	4 (6·5)	59 (93·5)
Brandy		11	1 (9)	—	10 (91)
Chloroform		14	1 (7)	—	13 (93)
Carminatives		10	—	1 (10)	9 (90)

(105 in 122) of the patients in our series obtained rapid and complete relief, and a further 11% (13 in 122) were relieved to a lesser degree. The necessary dose varied within comparatively narrow limits and rarely exceeded 1/50 gr. (0·0012 grm.). The tablets seldom produced severe unpleasant symptoms, which troubled only 1·5% (2 in 122) of the patients. They are convenient to carry, so that they are always available and are easy to take in attacks. They are also the cheapest of all remedies. Tablets with a lactose basis dissolve readily on the tongue and, as chewing is not necessary, they are invaluable for edentulous patients or for those for whom even the exertion of chewing a chocolate tablet is difficult during a severe attack. They also keep as well, do not deliquesce, are easier to assay, and retain their potency at least as well as those with a chocolate basis. As either kind of tablet deteriorates after a time, some control of the conditions of sale and storage is desirable.

The relief of attacks by glyceryl trinitrate is perhaps of less importance than its use for their prevention (Table III). In our series of patients the drug in tablet form almost always prevented pain when taken immediately before exertion. Eighty-five per cent. (61 in 72) of patients who used the tablets in this way obtained great benefit, and a further 12·5% (9 in 72) moderate benefit. This degree of improvement is superior to any which occurred spontaneously or was derived from remedies used in the investigation of continuous treatment. Whether the incidence of attacks may be controlled better by administering glyceryl trinitrate at short fixed intervals, such as every hour or so, than by allowing patients to take the drug as need arises, must be decided for each individual case. When attacks cannot be predicted with certainty, frequent regular administration sometimes has advantages, but general symptoms from the drug may then occur. Some patients who took glyceryl trinitrate every hour during the day were free from attacks, though previously there had been upwards of six a day. Most patients can predict attacks, however, and they then derive a greater benefit from a discriminate, rather than a regular,

administration. Moreover, disagreeable general symptoms are exceptional, and none of our patients gave up this method of prevention because of them.

A fundamental question is whether the artificial prevention of expected anginal pain is dangerous or not. In our series many patients used glyceryl trinitrate for the prevention of pain continuously for as long as two or three years, and often undertook physical exertion which previously had been impossible. Yet harmful effects were never met and no death occurred which could be attributed to the drug. With the use of glyceryl trinitrate tablets for the relief and prevention of attacks, 52 out of 122 patients were able to continue with their work in relative comfort. We concluded, therefore, that physical exertion may be permitted to most anginal patients, instead of the rest and inactivity which has been thought to be so imperative. If patients are able to take physical exercise or to follow their usual occupation in comfort, through the preventive use of vasodilators, then we believe that they should be permitted—and in proper cases encouraged—to do so.

Other drugs.—Nitrite administered in other ways did not give the same good results as glyceryl trinitrate tablets. The latter drug given in other forms was the next best remedy, but these cannot be recommended for general use. The alcoholic liquor glyceryl trinitratis (B.P. 1932) relieved anginal attacks quickly in rather more than half the cases only (Table II), and it compared unfavourably with the tablets, because it cannot be administered so quickly. It is also inconvenient to carry. These disadvantages preclude its regular use in treatment. Glyceryl trinitrate in oily solution failed to give any degree of relief in one-half the cases. None of the proprietary preparations of glyceryl trinitrate, namely natirose dragees (Nativelle), nitrolingual (Pohl), and trinitrine caféinée pills (Dubois), gave results as good as the tablets, and as they are much more costly they have no claim to preference.

Amyl nitrite proved much less effective than glyceryl trinitrate tablets in relieving attacks and was valueless for their prevention (Tables II and III). Commonly it caused unpleasant general symptoms (marked in 76% (48 in 63)) and none of 56 patients could be persuaded to continue using it after a just trial. Amyl nitrite cannot claim more than a minor place in routine treatment, and should be used only by those exceptional patients who do not obtain rapid relief from glyceryl trinitrate. Sodium nitrite, chloroform, brandy, and carminatives were also much inferior to the latter.

Conclusions.—The main conclusions of this investigation therefore were that :—

(1) None of the drugs used to reduce the number of attacks of angina of effort by continuous administration proved to have any value. They have no place in routine treatment.

(2) Glyceryl trinitrate in tablet form is the most effective remedy for the relief of individual attacks and for their immediate prevention. It may be used freely, but to be effective absorption must be allowed to occur from the mouth, and the tablets must be reasonably fresh.

(3) The prevention of attacks by a discriminate use of glyceryl trinitrate not only is safe, but allows anginal patients a fuller life of physical and mental activity than they can otherwise attain.

Dr. E. Stolkind said that he was very glad that Dr. Cotton and Dr. Bramwell agreed with his (the speaker's) theory of the pathogenesis of angina pectoris.[1] This theory was of great importance from the standpoint of treatment. According to it the attack of angina pectoris was brought on by a complex of three interwoven factors. Under the combined influence of (1) biochemical substances (products of abnormal secretions, metabolites, electrolites, etc.), and (2) pathological

[1] E. Stolkind, "Angina pectoris : Its pathogenesis," *Brit. Journ. Children's Dis.*, 1928, xxv, i ; *Proc. Roy. Soc. Med.*, 1928, xxi, 28 (Sect. Medicine), *Lancet*, 1932, ii, 627.

changes of every type and degree (in the coronary arteries, heart and aorta), the "original noxious irritation" began in the heart or aorta (or probably in both), and was transmitted (3) through the cardiac plexus by the connecting nerve-filaments, and, through the sympathetic and vagus, reached the central nervous system—the cortex (some attributed the pains to the thalamus opticus). Thus these three factors (A) biochemical, (B) nervous, and (C) heart and aorta formed a circular "chain" or circuit. A complex which might be expressed algebraically by the formula $A + B + C$. Whenever the combined effect of this "chain" reached a certain fixed degree (e.g. when $A + B + C$ equalled about 100—the individual factors might vary) there would be an attack of angina pectoris, i.e. the "circuit" must be closed. For instance, one of the three factors might become very pronounced and produce a strong stimulus, and the others be present in a sufficient degree, e.g. when embolism or thrombosis of the coronary arteries occurred and the "circuit" was closed; then in one case (when $A + B + C$ equalled 100) there would be a typical attack of angina pectoris, while in another, when this degree was not reached (e.g. when $A + B + C$ equalled only about 75) or when the heart was much diseased, only signs of heart failure were present.

The study of Pavlov's conditioned reflexes sufficiently explained the frequent recurrence of anginal attacks in patients. For instance, Dr. John Hunter used to say that any scoundrel could provoke in him (Hunter) an attack of angina pectoris by upsetting him. In such cases the nervous factor produced a strong stimulus, and the "circuit" occurred. In a patient of Leriche the electric stimulation of the left stellate ganglion caused intense pain and oppression in the præcordial region and the first two or three intercostal spaces. The pain and oppression subsided at once after injection of novocain into the same ganglion.

He (Dr. Stolkind) had collected from the literature cases of coronary thrombosis in which a post-mortem examination had been made. From these cases, as well as from his own, he concluded that in some cases of coronary thrombosis there were attacks of angina pectoris of short or long duration (status anginosus); in some cases only attacks of cardiac asthma occurred. In others there were only symptoms of increased dyspnœa and cyanosis; especially was this so when there was myocardial degeneration. It sometimes happened that, when the coronary thrombosis occurred slowly, the patient did not complain of heart trouble.

He was convinced that dental or other focal sepsis had no influence in causing the attacks of angina pectoris. The craze for extraction of all the teeth in patients suffering from angina pectoris or from any diseases of the circulatory or any other system only did harm to the patient. People had died as a result of the unnecessary extraction of their teeth.[1]

[1] E. Stolkind, "Irrational extraction of the teeth," *Proc. Roy. Soc. Med.*, 1926, **xix** (General Report), 20; *ibid.*, 1928, **xxi**, 81; 1930, **xxiii**, 1166; 1931, **xxiv** (Sect. Odont. 4).

United Services Section

President—Major-General P. H. HENDERSON, C.B., D.S.O.

Some Atmospheric Hazards Encountered in Naval Life

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THESE discursive remarks are intended to draw attention to a few of the ways in which the surrounding air may imperil the life or health of the sailor. The subject is far too large to allow of more than a mere indication of a few of its more important, interesting, or recent aspects.

The changes which may occur in the atmospheric environment and affect health may be divided into three classes.

(1) Extreme physical changes, without alteration in the chemical composition of the air—such as high and low temperature, high and low barometric pressure, or violent movement of air in blizzards, whirlwinds, and so on.

(2) Variation in the proportion of the gases which normally compose the air, e.g. deficiency of oxygen, excess of carbonic acid, and changes in the humidity.

(3) The addition of poisonous substances to the atmosphere, e.g. dusts, smoke, coal-gas, or other noxious vapour. As regards this last class, only accidental contaminations will be considered; the deliberate use of poisonous gases as a war weapon and the diffusion of industrial dusts are not included.

Incidentally the atmosphere may become prejudicial to health by a combination of two or more of the kinds of changes given above. A deficiency of oxygen, negligible at normal barometric pressure, may become serious at low pressures such as are encountered in high flying or on mountain tops, and air at a temperature of 100° F., when saturated with water vapour is incompatible with life, although conditions may be quite comfortable in dry air at this temperature.

Hot atmospheres.—When the temperature of the air, as registered by the dry-bulb thermometer, approaches that of the human body, the wet-bulb temperature, which indicates the potential cooling power of the air, is the important index on which to judge the suitability of a hot atmosphere for human occupation, e.g. say the wet bulb registers 80° F., the conditions of comfort will be practically the same whether the dry bulb measures 120° or 85° F. (provided the air movement is the same on both occasions). Yet, although we all realize this, human nature being what it is, we are unable to resist the lure of high figures, and are prone to boast of our fortitude in having endured a temperature of 120° F. in the dry Egyptian desert to the man who admits that he felt like a rag at 85° F. in the steamy atmosphere of the Persian Gulf. So conservative are we, that sometimes even to-day only the dry-bulb temperature is used as an aid in judging the advisability of going into tropical rig, or the amount of hardships endured by those who have to work in high temperatures.

In hot atmospheres the amount of movement of the air is all important, and for this reason the katathermometer should be the instrument of choice in estimating the salubrity of the atmospheric environment, because this instrument measures directly the cooling capacity of the air at approximately normal body temperature. The dry katathermometer estimates the cooling action of the air on the human body when the skin is dry and the cooling effect of evaporation is not at work. In hot climates and places where the temperature is at or above the body

temperature, heat loss depends almost solely on the evaporation of sweat and the wet katathermometer must then be used. In fact, this instrument may be looked on as a small model of a sweating man. In using it one takes the time the temperature drops from 100° to 95° F. This time in seconds divided into a factor which is marked on each instrument, gives the " kata figure," which is the number of microcalories per second per sq. cm. of surface, lost at approximately normal body temperature.

At temperatures exceeding 95° F. the dry katathermometer cannot be used, as cooling at body temperature then depends almost entirely on evaporation. An example from a series of katathermometer readings which were made on a cruiser in tropical waters will make the use of the instrument clearer (Dudley, 1928). The cruiser's switchboard room was one of the hottest places in the ship. It was supplied with a powerful table fan to keep the air in motion. When the dry katathermometer, previously cooled to 95° F., was held just in front of the fan it went up, because the air was 117° F., and the closer the instrument was brought to the fan the faster the index column rose, which showed that the more rapid the motion of the air the more rapidly the instrument was heated. But although the wet-bulb temperature at this time was 92° F., so great was the draught from this fan that a wet katathermometer, held a foot in front of it, dropped from 100° to 95° F. in 37 seconds, which corresponded to a wet " kata figure " of 12·6. Incidentally, a figure of 10 is quite comfortable when one is in tropical clothing. The figure of 12·6 was, of course, only directly in front of the fan. In the centre of the compartment the figure was only 3·8, an almost unbearable atmosphere to most people. Nevertheless, four switchboard watchkeepers did light work in this atmosphere for six hours a day, for weeks on end, without any bad effects; they wore only a pair of shorts, and were bathed in sweat. It would appear to require a certain time to become acclimatized to such an atmosphere, because I felt faint and uncomfortable during the half hour I spent in this room collecting my data, and afterwards had a slight headache.

The contrast in the behaviour of the dry and wet katathermometers in the switchboard room illustrates the fundamental physiology and physics of human heat-stroke. The men, while in this atmosphere, were soaked in perspiration, the evaporation of which kept their temperature down just as in the case of the wet katathermometer. Seeing that dry-bulb temperatures of over 130° F. had been recorded in the switchboard room's log book, with wet-bulb temperature only six or so degrees below normal body temperature, the sweating mechanism was able to keep the men's temperature 30° or more below that of the surrounding air.

In heat-stroke and the hyperpyrexia of certain fevers the sweat glands cease to function—as indicated by the dry skin—and the body will then act like a dry kata-thermometer. If the air is hotter than the patient, the more one fans him the more quickly his temperature will rise. If now one makes the patient imitate a wet katathermometer by wrapping himself up in a wet sheet, the water in the sheet replaces his absent sweat, so that now the more vigorously he is fanned the more quickly he will get cool.

The evaporation of 1 c.c. of water abstracts 500-600 gram calories of heat from its immediate surroundings—a fact never to be forgotten in the tropics at times when no ice is available.

While on the subject of high temperatures, I would like to draw attention to some recent work by Crowden (1934) in co-operation with the hygienists of the Army, on the use of aluminium foil as a protection from radiant heat. For practical use, this aluminium foil is backed by parchment paper or asbestos fabric. If a layer of this material is fixed so as to divide an inch space into two spaces, each half an inch in depth, it will hinder the transference of heat as efficiently as a slab of cork one inch thick. The method depends on the fact that bright aluminium foil reflects

most of the heat rays and radiates very few, i.e. it has a very low emissivity for heat. It was found that iron huts lagged in this way were as cool in the tropical sunshine as well-built, but most expensive, hospital buildings lagged with cork. The material has also proved satisfactory for lining solar helmets, ambulances, ice boxes, &c. General Henderson (1934), the Army's Director of Hygiene, says that: "The insides of tents where foil was applied, instead of being almost unbearable from the excessive heat, were compared to the shade of a tree covered with thick foliage."

It needs no imagination to see how valuable this form of heat protection would be in the Navy. Besides being much cheaper than any other type of lagging which is equally effective, aluminium foil is relatively many times lighter. In warships, efficient heat-insulation has heretofore had to give way to prior considerations of weight. It would probably be found possible by lagging with asbestos reinforced foil, to prevent the escape of "wild heat" from the engine and boiler rooms, and limit the entrance of solar radiation through the decks and sides of the sick bay and all living spaces of the ship, at a cost in money and weight considerably less than is at present incurred in extra awnings, side screens, and the steel lagging of certain special parts of the ship. One can envisage how a Red Sea sloop or a river gunboat, at present more comparable to red-hot sardine tins, could be transformed into cool retreats from the burning sunshine and dazzling glare of a tropical sea or river.

Caisson disease.—The next atmospheric hazard is increased atmospheric pressure. Pressures which are much greater than at sea-level have to be endured by divers, and by the victims of a submarine disaster, because, before they escape from the boat, the air pressure inside has to become equal to that of the water outside the boat in order to raise a hatch. Under ordinary conditions the barometric pressure inside a submarine is about the same as that at sea-level, to whatever depth she dives—the excess of hydrostatic pressure being taken by the hull.

Exposure to high pressure is the cause of caisson disease. At sea-level the pressure is roughly 15 lb. per sq. inch. This is equivalent to about 30 ft. of water, so the pressure of water at, say, a depth of 120 ft., would be about four atmospheres, to which must be added the normal atmospheric pressure on the surface. At such a depth, therefore, a diver would be exposed to a pressure equal to five atmospheres. Now air, and all gases, are dissolved in fluids in amounts which are directly proportional to their pressure. Thus, the blood and tissues of a diver who has descended to 120 ft. are potentially capable of dissolving five times the weight of air that they can hold in solution at sea-level. When, therefore, a diver is brought suddenly to the surface, the excess of air, or rather nitrogen, escapes as bubbles into the blood and tissues, in exactly the same way as bubbles appear in the previously still fluid in a soda-water bottle once the pressure is relieved on drawing the cork. At a post-mortem examination of a fatal case of caisson disease these bubbles are visible under the serous membranes and can be seen to have disrupted the brain, spinal cord, and other tissues. In mild cases there may only be pains in the joints and muscles (bends). Other cases show nervous and renal symptoms, going on sometimes to coma, anuria, and death. The only treatment is immediate decompression, even to the extent of lowering an unconscious diver over the side again if no proper decompression chamber is at hand. Caisson disease is prevented by the diver coming up slowly in stages. The time he waits at each stage depends on the depth, and the length of time he has been down. For example, an hour's work at a depth of 200 ft. would necessitate two hours being occupied in the ascent to the surface. The various times required for ascent from different depths under various circumstances were worked out many years ago by Leonard Hill (1912) and his collaborators, and are tabulated in the naval diving manual. Of recent years means have been devised to enable divers to work at depths of 300 ft. in an ordinary diving suit. A steel chamber filled with pure oxygen is lowered to meet the ascending diver, and

in this he undergoes the last stages of decompression in comfort. The effect of the oxygen is to shorten the time required for decompression by a half to a third that required in ordinary air. The oxygen combines with the tissues and will therefore not produce bubbles when the pressure is lowered. Nitrogen, on the other hand, is chemically inert, and only goes into solution in the tissues to reappear as bubbles when the excess pressure is released. At first there was considerable anxiety about the possibility of oxygen poisoning. Animals which breathed pure oxygen at a pressure of three atmospheres got convulsions and some subsequently developed pneumonia (Leonard Hill, 1912). Two atmospheres, however, appear to be safe, since Phillips (1931) reports that divers have breathed oxygen at two atmospheres for eighty-eight minutes without untoward effects. This is equivalent to a pressure tenfold that normally breathed, as the partial pressure of oxygen at sea-level is only one-fifth of an atmosphere. The divers themselves were convinced that oxygen kept them fit and gave them a sense of well-being. One may note that the poisonous effect of oxygen when the pressure approaches three atmospheres probably limits the depth to which a diver may safely descend in an ordinary diving suit, because a diver at 420 ft. would receive normal air under a pressure of 15 atmospheres, equivalent to the three atmospheres of pure oxygen, a concentration which has been proved poisonous to experimental animals.

Submarine escape.—The reason for reviewing the subject of caisson disease is to make it easier to understand a much less familiar accident which results from rising suddenly to the surface from any depth. The U.S. navy have had several fatalities from this cause during the practice of submarine escape. In their escape-drill a line is always used for the man to come up on. At marked intervals on this line the man pauses, and takes one or two deep breaths into his escape apparatus, to prevent a sudden rise of intrathoracic pressure. The accidents have all happened when men have let go the line and come suddenly to the surface. The chief symptoms were an almost immediate loss of consciousness and fall of blood-pressure often terminating in death within the hour. The American authorities at first favoured the view that these disasters were caused by the rapid expansion of the air in the lungs and hollow abdominal viscera producing an excessive intrathoracic pressure which, in turn, caused paralysis of the respiration and heart. There were reasons for not being satisfied with this hypothesis. At one post-mortem examination bubbles of gas were visible under the visceral pleura and in other parts of the body, and it was suggested that in some way the man must have got caisson disease. Now most of these accidents have occurred in men who have only come up from about a depth of 30 ft. In this instance the man in question had only been submerged for six and a half minutes at a depth of 25 ft., and caisson disease never develops at depths of less than 42 ft., even after an hour's submersion. In caisson disease also there is always some delay before loss of consciousness. Leonard Hill (1912) gives an analysis of 20 fatal cases. The shortest time in which loss of consciousness occurred was ten minutes, and only two patients died within an hour of the release of pressure. In these American submarine-escape fatalities consciousness was lost within a minute of breaking surface.

In a British submarine disaster which happened a few years ago some men escaped after being exposed for some length of time to a hydrostatic pressure of about 120 ft. One of these men was picked up dead within a few minutes of breaking surface. At an autopsy air-bubbles were seen in the tissues and the cause of death was considered to be caisson disease. There is little doubt that this man may have had potential caisson disease at the time when he died, especially as some of the survivors from the same submarine exhibited mild symptoms of the disease after their rescue, but it is improbable that caisson disease, even if present, was the cause of death. In a report which I made on the medical aspects of this disaster it was suggested that the cause of death was similar to those which had occurred

in America during submarine-escape drill. Because, when a man, as in this case, ascends to the surface from a depth of 120 ft., the volume of air in his lungs and hollow viscera will tend to increase fivefold, and should the air be prevented from escaping and expanding, the pressure inside the chest would be five times as great (75 lb. per sq. in.) as the air at sea-level outside the chest. Of course, the elasticity of the diaphragm and abdominal wall would allow of some expansion and reduction of intrapulmonary pressure, even if no air escaped from the nose and mouth during the ascent. Generally, as a man rises up through the water, the air irresistibly rushes out through his mouth and nostrils and prevents any dangerous rise of intra-thoracic pressure. It seemed to me possible, even if improbable on physiological grounds, that such a sudden rise of intrapulmonary pressure might force air through the alveoli into the circulation and cause death from air embolism. Such a hypo-thesis fits in very well with the symptoms exhibited by the American casualties and explains the presence of air in a body which had only been exposed to a pressure of 25 ft. of water. I therefore tentatively suggested that mechanical rupture of the lungs rather than caisson disease was the cause of the death of the British submarine rating. Subsequently Polak and Adams (1932) verified this " burst lung " hypothesis on dogs. They demonstrated that it was possible, by suddenly raising the intrapulmonary pressure, to rupture the alveoli and force air into the pulmonary veins, thence into the left heart, whence bubbles were distributed all over the body simulating caisson disease. These authors therefore concluded that some submarine-escape fatalities are caused in the same way.

The practical lesson taught by these disasters and experiments is that, although it may be undesirable to complicate a genuine escape, yet when men are being instructed in submarine escape it is advisable, when ascending from greater depths than 10 feet or so, to use a line, this line to be marked at intervals at which the men would check their ascent for a few seconds and take a deep breath or two, in order to allow time for the pressure in their lungs and escape apparatus to become equal to the hydrostatic pressure at whatever level they might happen to be. The men should be told that under no circumstances should they do anything to prevent the free escape of air from their mouth, nose, and apparatus during their ascent to the surface. Note, that the slow ascent is not comparable to the prolonged ascent which is necessary to prevent the development of caisson disease, nor is it made for the same reason. In the latter case hours may have to be allowed for the dissolved nitrogen to diffuse out of the tissues into the blood and out of the blood into the alveoli of the lung. In submarine escape only a few seconds' pause is advised, in order to make certain that the compressed air has time to escape up the bronchi and out of the mouth, nose, and escape apparatus.

Excess of carbon dioxide.—During the last half century our views on the vitiation of the atmosphere by the carbon dioxide produced by respiration and com-bustion have undergone a gradual change. It is now realized, especially as the result of submarine experience, that carbon dioxide in itself is innocuous in con-centrations below 3%, which is more than one hundred times the amount normally present in the ordinary open air. Under certain conditions a slight excess may even be beneficial, perhaps this is the case in sleep, as one observes that many animals, and children, will cover their noses while asleep, a habit which must entail much rebreathing of expired carbon dioxide. When the concentration of carbon dioxide rises above 3%, symptoms of respiratory embarrassment begin to appear. First, merely an unnoticed increase in the respiration rate, followed by panting and gasping and, finally, when the concentration of carbon dioxide exceeds that in the pulmonary alveoli (normally about 5·5%) convulsions and death. A further important effect of carbon dioxide concentrations of over 3% is an insidious impairment of mental capacity, which may lead to errors in behaviour and judgment.

One source of carbon dioxide is the spontaneous oxidation of certain vegetable substances, e.g. hay or tobacco. Fatal accidents have arisen from this cause when men have entered unventilated store-rooms containing these, or similar, products. Frederick (1920) found high concentrations of carbon dioxide in air-samples from such store-rooms. He discovered that percentages up to 50 could be produced in sealed vessels containing moist tobacco or hay. In some way the evolution of carbon dioxide depends on moisture, since little oxidation takes place if the material is dry. It is not due to bacterial decomposition, as the carbon dioxide is still produced under sterile conditions. Neither does it seem to correspond to that produced by the respiration of stored *live* fruit and vegetables, since tobacco and hay are physiologically dead. Frederick's important investigations led to the Admiralty orders concerning the storage of such substances, and the precautions that were to be taken to prevent the repetition of the disasters referred to above. Incidentally, Haldane and Makgill have recently (1934) published work which confirms the main conclusions which Frederick made fourteen years ago. One may note that the combustion of ordinary lamps, stoves, and fires in ill-ventilated rooms cannot produce a dangerous concentration of carbon dioxide, because a man can still breathe comfortably in air which will not support combustion. Leonard Hill (1920) states that the vitiation of the atmosphere in a battered-down trawler's cabin may become so great as to put out the lamp. Yet fishermen, provided they are not drowned, have a greater expectation of life than those engaged in almost any other occupation, so that air, grossly vitiated by respiration, cannot in itself be very deleterious to health.

Air contamination in submarines.—During the production of carbon dioxide by respiration an equivalent amount of oxygen is removed from the atmosphere. Under such conditions, when the carbon dioxide has risen to 3% the oxygen will have fallen to about 18%. The symptoms which begin to appear at this point are due to carbon dioxide, because if that is removed the oxygen concentration can fall to 14% before signs of respiratory embarrassment appear. In sealed compartments, the absorption of carbon dioxide should theoretically double the length of time the atmosphere will support life.

In cases, such, e.g. as a submarine disaster, in which it is desired to keep the atmosphere respirable for as long as possible, men not doing necessary work should lie flat on the deck. Smoking should be forbidden; incidentally it will not be possible to smoke once the carbon dioxide has reached 3%. If the atmosphere is hot the men should strip naked to avoid the unnecessary expenditure of energy required for sweating. By these means the volume of oxygen required per man is reduced to about 0·6 cu. ft. per hr., and the victims may be able to survive nearly twice as long as when men are allowed to rush about making hopeless efforts to escape, and give those outside the boat twice the time to effect a rescue.

While on the subject of submarines, the possibility of two other lethal gases contaminating the boat's atmosphere has to be mentioned. When sea-water gains access to the secondary electric batteries of a submarine it will be electrolysed and chlorine may be evolved in dangerous quantities, a cause of some accidents in the past. The other poisonous gas is arseniuretted hydrogen. Some unique cases of chronic poisoning by this gas, as distinct from acute poisoning in industrial processes, happened during the war. The history of the incident is instructive (Dudley, 1919-20). Some men from the Harwich submarines were sent to Chatham Naval Hospital, and were supposed to be suffering from carbon monoxide poisoning. I was asked to examine their blood for carbon monoxide. When I saw the men they were slightly jaundiced. They gave a history of having been violently sea-sick, although many were hardened seamen who had never been sick in their lives. They also stated that at the time of their sickness they had noticed that their urine was port-wine coloured. Blood-counts revealed that some of them had less than two million red cells per c.mm. This combination of symptoms and history could only

be produced by one thing—arseniuretted hydrogen. The Admiralty were therefore informed that there was arseniuretted hydrogen in some of the Harwich boats, and on the next day Professor Haldane found it in their battery gases. The source was arsenic in the lead-antimony alloy used for making the secondary battery grids which, owing to the stress of war, was not up to its proper specification. Considering the deadly nature of the gas, it is fortunate that the amount of arsenic was so small, as otherwise one would have expected—from industrial experience of arseniuretted-hydrogen poisoning, that when the whole crew of a submarine was submerged for eighteen hours in such an atmosphere, they would have perished, and the boat have been lost without anyone ashore suspecting the real reason of its non-return.

Atmospheres in sealed compartments.—Many disasters in the past have arisen through men entering spaces which have been hermetically sealed for some time previously, such as the double bottoms and bulges of ships. Such spaces may contain practically no oxygen and as much as 97% of nitrogen. The oxygen is absorbed by the linseed-oil in the paint used to protect the interior of sealed compartment, and is not replaced by carbon dioxide as in respiration, combustion, or the oxidation of tobacco, &c. In fact, the gas in such compartments is under a negative pressure, as was noted when holes were drilled in them to get reliable samples of gas for analysis. Anyone entering such an atmosphere is suffocated even more rapidly than he would drown in water, because breathing freely in an atmosphere which is practically pure nitrogen rapidly washes out the reserve oxygen from the lungs and tissue—a reserve ordinarily sufficient to allow a man to survive three or four minutes under water if he holds his breath.

The bodies of men who have been suffocated in sealed compartments often exhibit a lifelike pinkish complexion, an appearance which has sometimes been responsible for a false diagnosis of carbon monoxide poisoning. This type of sudden death is always due to lack of oxygen; although carbon monoxide is often present, yet death from that poison is a relatively slow process. In a man found dead from carbon monoxide poisoning, the blood will be found to be from 70% to 80% saturated with the gas, and after death the gas will remain bound to the hæmoglobin for months. Therefore a man who is *brought out dead* from a sealed compartment cannot have died from carbon monoxide poisoning if the gas is not easily detected in his blood. The most delicate test for carbon monoxide in the blood is Hartridge's reversion spectroscope, the use of which has been described in detail by Frederick (1931). With this instrument one can detect traces of carbon monoxide in the blood of a subject who has just smoked a couple of cigarettes. In some investigations in which mice were exposed to various concentrations of the gas, Frederick was able to detect it in the blood of the control mice. This was puzzling till it was realized that the animals' cage was on a shelf above a gas-ring which was used for boiling up their food, and this gas ring was the most probable source. Although the gas is easily detected in one who has been fatally poisoned before being removed from contact with it, yet, if the man survives, or lives for some time after having been removed from the poisonous atmosphere, the carbon monoxide may have all been washed out of his system by the time a sample of blood is obtained for examination, and the gas will disappear still more rapidly should oxygen and carbon dioxide have been used to resuscitate the victim. This is the reason for the Admiralty order requesting that blood from suspected cases of carbon monoxide poisoning should be collected at the earliest possible moment after the exposure to the suspected atmosphere. Of course, even if blood-collecting apparatus is handy, the medical officer must concentrate on resuscitating the victim before worrying about getting a sample of his blood.

The story of the discovery that carbon monoxide was a common constituent of the atmosphere in sealed compartments is worth recording. A man entered a ship's bulge before it had been ventilated as required by the regulations. He was brought

out dead and the corpse exhibited the pinkish colour mentioned above, so that at first the man was thought to have died of carbon monoxide poisoning. In a sample of his blood, taken at the autopsy and examined at Greenwich, no trace of the gas was detected. Therefore it was evident that the man had not died from carbon monoxide poisoning but had been suffocated in an atmosphere deficient in oxygen. It had, of course, been known for many years that the oxygen in these sealed compartments disappears after they have been closed for some time. However, in view of the original diagnosis of carbon monoxide poisoning, chiefly in order to satisfy those concerned, it was decided to analyse the air of some sealed compartments. Contrary to all expectation, it was then discovered that dangerous amounts of carbon monoxide could be present in them. Nevertheless, as there was practically no oxygen in these atmospheres, a man would "drown" in them long before he could absorb a physiologically significant quantity of carbon monoxide. Thus a false diagnosis of death from carbon monoxide poisoning led to the discovery that the victim had been asphyxiated in an atmosphere which probably contained carbon monoxide, but that the latter gas had nothing to do with his death. An event in some ways analogous to the false diagnosis of death from caisson disease in the victim of the submarine disaster who most probably died from mechanical rupture of the lung.

Further investigations (Dudding, Dudley, and Frederick, 1931) showed that the source of the carbon monoxide was the linseed-oil in the paint used to protect the inside of the compartments which, while it absorbs the oxygen, gives off small quantities of the former gas.

At first sight it might appear as if the presence of carbon monoxide in such atmosphere was of little practical importance, as any subjects exposed to them would die of oxygen-lack, long before they could absorb a dangerous amount of carbon monoxide. But this is not necessarily true, because it was found possible to arrange conditions with sealed petrol-tins, paint, and mice, so as to produce an atmosphere that would support respiration long enough for the mice to die of carbon monoxide poisoning, as was proved by finding their blood to be from 70 to 80% saturated with the gas (Dudley, Edmed, and Frederick, 1933). These experiments demonstrated that the same thing might happen when men and sealed compartments were substituted for mice and petrol-tins. For instance the atmosphere in the compartment might originally contain too little oxygen to support life, but if, after being opened, it was only partially ventilated, enough oxygen might have been introduced to make the air respirable, but enough carbon monoxide left in it to leave the air poisonous. Thus the order designed to prevent such accidents must be carried out strictly, as the air may become breathable before it becomes safe.

The result of the investigations at Greenwich makes it not improbable that the incomplete ventilation of a compartment containing carbon monoxide was the cause of a catastrophe in U.S.S. *New York* (Anon. 1931) in which nine men entered a bulge and showed symptoms more consistent with carbon monoxide poisoning than with ordinary asphyxia. Moreover carbon monoxide was found in the blood in the only two fatal cases. A similar accident also occurred in U.S.S. *Nevada*. The American naval authorities were at a loss to account for the origin of carbon monoxide in these disasters, but there can now be little doubt that it came from the paint.

Smoke fumes and carbon tetrachloride.—Gassing by the fumes produced in accidental fires is not uncommon. Olsen, Ferguson, and Scheflan (1933) have shown that the complete or partial combustion of common materials such as clothes, furniture, wood, paper, and indiarubber can produce the following gases in dangerous concentrations:— carbon monoxide and carbonic dioxide, sulphuretted hydrogen, hydrocyanic acid, sulphur dioxide, ammonia, and nitrous fumes. These gases are all either asphyxiants or lung irritants and need no further comment except to note, as regards the fighting

services that nitrous fumes are of special importance, since they are given off in quantity when cordite or other nitrogenous explosives are ignited, and were the cause of some naval casualties during the Great War.

The following history of two cases of a different type of gas-poisoning which arose in connexion with accidental fires is interesting (Dudley, 1935) :—

A man was admitted to hospital with symptoms of gastritis which disappeared within forty-eight hours by which time he had developed jaundice. His urine then became very scanty and albuminous, and the urea concentration and blood-pressure steadily mounted until, on the ninth day after his admission, he developed pulmonary œdema, urœmic convulsions, and finally coma. His life was now despaired of, but he suddenly got polyuria and made a miraculous recovery. After having been tentatively diagnosed as one of gastritis and catarrhal jaundice, the case was officially classed as one of acute nephritis. During this patient's convalescence another man was admitted with abdominal pain and hæmatemesis. These symptoms subsided rapidly and were not succeeded by jaundice or any other noteworthy signs except almost complete anuria. The patient gave a history of having spent some time on the day before the onset of his symptoms in putting out a fire in a small enclosed space, with patent spray extinguishers. Now, at first, this incident seemed irrelevant until it was found out that the spray consisted of carbon tetrachloride (CCl_4). This substance belongs to the organic halogen compounds, many of which are known to have a selective poisonous action on the kidneys and liver. In fact carbon tetrachloride was once used as an anæsthetic ; but its use was abandoned when it was found to be more poisonous than its close chemical relative, chloroform ($CH.Cl_3$). Carbon tetrachloride is commonly used as an antihelminthic and its action in damaging the kidneys and liver of especially susceptible subjects, when taken by the mouth, is well known. Therefore there was little doubt that this second patient was suffering from the effects of carbon tetrachloride vapour poisoning. Sir William Willcox, who saw the patient, confirmed this diagnosis. The man had anuria for ten days during which his blood-urea rose to 300 mgm. per 100 c.c. He was mentally normal and felt comparatively well all the time. On the eleventh day the kidneys began to function again and he was practically well within a fortnight. This was one of the most remarkable and prolonged cases of complete suppression of urine ever recorded.

Let us now return to the first case supposed to be recovering from an infective nephritis, a diagnosis with which I was still satisfied, even after the second case had been recognized as one of carbon tetrachloride poisoning. In casual conversation the patient was asked if he had had anything to do with fire extinguishers. "Oh yes," he replied, " I put out a fire in the ship's office with a spray extinguisher the day before I went sick." At once all the anomalies and peculiarities of this patient's illness disappeared as his case was reviewed on the assumption that he had been poisoned by carbon tetrachloride. A similar case was reported from Paris, following the use of a spray fire extinguisher, and further cases in all aspects like these two have resulted from the use of carbon tetrachloride for dry cleaning, when there was no admixture with smoke fumes.

The literature shows that poisoning with carbon tetrachloride vapour generally begins with stomach symptoms (hence the original diagnosis of gastritis in the first case) followed shortly by jaundice (hence the second diagnosis of catarrhal jaundice) and frequently the kidneys show a greater or less degree of parenchymatous necrosis (which had led to a third diagnosis of infective nephritis).

The most instructive lesson of this episode is the missing of the diagnosis in the first case by several physicians of at least average ability, and who, by force of their naval and active service experiences, had far more knowledge of gas poisoning and atmospheric hazards than the great majority of medical men outside the services. Moreover, the diagnosis in the second case also would probably have been missed unless one of the hospital officers had happened to know that the patent fire extinguishers' in question contained pure carbon tetrachloride, a fact which is by no means common knowledge. If, under such favourable circumstances, cases of carbon tetrachloride vapour poisoning were missed, it is possible that many such have been overlooked elsewhere and have been diagnosed as ordinary examples of gastritis, influenza, jaundice, or nephritis.

Incidentally, it must not be considered that these accidents should in any way prohibit the use of the valuable type of fire extinguisher concerned. Such extinguishers must have saved many lives and much valuable property, and, at the most, they can only have caused a few cases of temporary non-fatal illness in especially susceptible subjects.

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Section of Odontology

President—FRANK COLEMAN, M.C., L.R.C.P., M.R.C.S., L.D.S.E.

[*November 26, 1934, continued*]

The Aftermath of Apicectomy

By A. H. PARROTT, O.B.E., M.D.S.B'ham., L.D.S.Eng., and A. W. WELLINGS, M.D.S.B'ham., L.D.S.Edin.

History.—The patient is a girl, who was aged 16 in 1918. In July of that year 2 | pulp was destroyed with arsenic and the root was filled with G.P. points in August. A Logan crown was fixed in October of the same year.

A skiagram taken in 1922 showed the presence of an "apical area."

Apicectomy was performed in October 1926 (figs. 1 and 2). Films taken in 1929 still show the presence of slight "areas" over 21 | . An examination of | 2 in October 1929 showed the pulp to be vital at that time.

Following an attack of mumps in December 1931, a swelling appeared over the region of the root of this tooth, and X-ray examination showed extensive rarefaction (fig. 3).

The condition was treated, the dead pulp removed, and the root filled with G.P. in January 1932 (patient then aged 30). Skiagrams taken in February 1932 showed no area (fig. 4). All incisors were extracted in August 1933 for æsthetic reasons. 2 | 2 were sent for bacteriological and microscopical examination.

Bacteriological report (by A. W. W.).—(1) Cultures from swab of tooth after apicectomy show a few colonies of a hard *Micrococcus catarrhalis*. (2) Cultures from the apex of the root-filled tooth show a profuse growth of the same organism.

Microscopical report (by A. W. W.).—After the swabs had been taken both roots were put into 10% formalin and sent for microscopical examination. The resected one had a very small granuloma attached to the resected surface, while the unresected root-filled root had a fairly rounded apex with no evidences of absorption. After fixation, they were decalcified, sectioned and stained with hæmatoxylin and eosin.

The unresected root (| 2).—The irregular outline of the dentine at the apex of the root seems to indicate some destruction of that tissue as a result of the acute inflammation culminating in an abscess. This has been replaced by hyperplastic cementum which is considerably thicker in some places than others. Portions of the periodontal membrane which were adherent in places appear to be quite normal. From the sections it appears that the apical foramen is completely sealed by cementum. It is, however, only possible to be quite sure of this in a vertical section through the centre of the pulp canal to the apex. In this respect the sections are unfortunate but the deduction appears to be warranted.

The resected root (2 | , figs. 5 and 6).—The dentine is cut obliquely across with a clean cut reaching to the cementum on the one side, but sloping considerably on the other before the original cementum is reached. Attached at either end of the section, and continuous with the periodontal membrane at both sides, is a small round-celled granuloma becoming fibrous, measuring one millimetre in its widest part. This has pulled away from the dentine in the middle two-thirds, leaving a space between the dentine and the granuloma. The cut edge of the dentine is clearly shown ; and although irregular under magnification there are no evidences of absorption here ;

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but on either side, especially that considerable slope already mentioned, there are some bay-like excavations, probably evidences of old absorption from the original inflammation. These are filled in by a deeply-staining tissue which goes to join the cementum on the side of the root, and is continuous with a dark ribbon of calcified material lining the dentinal aspect of the granuloma. This is pulled away from the dentine for a considerable area—undoubtedly the result of manipulation. In one
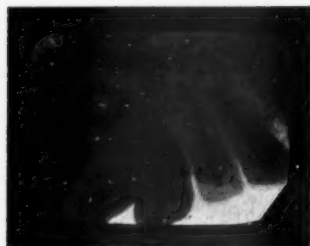

FIG. 1.—(1 | Apex resected September 1918): no area. 2 | Before apicectomy: shows area. *September* 1926.

FIG. 2.—Regenerated areas 21 | after operation (1926). *December*, 1931.

place a narrow strip is seen looped in the space between dentine and granuloma, and continuous with the darkly staining tissue on the slope, and adherent to the calcified tissue attached to the granuloma. In the granuloma itself, besides the round cells and fibrous tissue, there are large bodies, some quite circular, others oval or irregular in shape, which take the eosin stain. Their nature is very puzzling. Some of them, the more irregular ones, may be degenerated giant cells, though I cannot convince

FIG. 3.— | 12 diffuse area around | 2. Dead pulp *in situ. December*, 1931

FIG. 4.— | 2 after root treatment: no area. *February*, 1932

myself that the extremely scanty nuclear appearances that may be present, do not belong to subjacent round cells, for the section is very thick; but the circular nuclear-free body which can be seen in the section is certainly not a giant cell. I rather incline to the opinion that they are evidences of slow calcific changes taking place in the granuloma, especially as on the outer surface, at one point, there is an island of bone appearing, as is shown in an illustration (not reproduced). As to

the nature of the new tissue covering the excised dentinal surface, it can only be immature cementum or bone, it most certainly is not dentine.

The manner of its lamination, its continuity with the root cementum, and the presence of indistinct outlines of large cement lacunæ, suggest that it is the product of cementoblasts that may have crept along from the adjacent periodontal membrane, or developed from some of the cells of the granuloma. Anyone familiar with the appearance of developing cementum could hardly doubt that, after a thorough examination of all the sections, the tissue under discussion is cementum. There has not been time to consult all the references to the subject, but Kronfeld quotes a case described by Coolidge which was examined fourteen years after the operation and had resulted in complete regeneration of the bone. The root-end showed the presence of cementum upon the dentine and a fibrous tissue extending between the new cementum and bone in no way differing from normal periodontal membrane.

× 20

Fig. 5.—Granuloma attached to the resected root. It is continuous with the periodontal membrane on either side. The tissue at the extremities is darkly stained, between which the granuloma has been pulled away from the dentine. A narrow strip of curled-up calcified material is clearly shown.

In the present case it must not be overlooked that seven years had passed since the operation before the extraction was done, so that the regenerative changes have been very slow, but there are evidences that they are still in progress, and it is possible that in time they would have been complete.

This case has been recorded for two reasons :

(1) The opportunity of comparing cultural results of two teeth 2 | 2 removed from the same mouth at the same time, both root-filled, one of which had been resected at the apex. It is of interest to note that while the resected root showed a very mild culture of *M. catarrhalis*, the unresected one gave a much more vigorous growth of the same organism. Clinically, before extraction no pathological

FIG. 6.—Shows (1) area of newly formed bone on outer side of granuloma. (2) Darkly
stained cemental tissue pulled away from dentine.

symptoms were observable in either tooth, subsequent to treatment of dead pulp in |2
(January 1932).

(2) The microscopical study of the dentine cut across by resection, after a period
of seven years. The sections seem clearly to demonstrate the possibility of re-
generation and proliferation of cementum over the cut tubules.

A Case of Birth Injury of the Jaw

By J. G. TURNER, F.R.C.S., L.D.S.

THE patient is a boy, aged 12 ; a forceps baby. At birth there was a wound of
the right cheek, the scar of which is still visible. On the left side the bones of the
temporal region are depressed slightly. On the right side the dental arches, upper
and lower, are rather flattened ; the right upper lateral incisor overlaps the central,
while the left is practically normal.

The chief point of interest lies in the condition of the palate. On the left
(uninjured) side it is normal, while on the right (the injured side) it is high.

Obviously the condition is due to the birth injury. There are two possible
explanations—distortion and arrest of growth. Both have probably played a part,
but it is noteworthy that the level of the bite plane is normal all round the dental
arch. The parts of later formation have grown to their full dimensions ; only the
palate portion which received the full force of the birth injury remains under-
developed.

I have not yet been able to get a report on the nasal condition.

The case points to post-natal interference with growth as an important factor in
the production of a high-arched palate.

JOINT DISCUSSION No. 4.

Section of Epidemiology and State Medicine and Section for the Study of Disease in Children

Chairman—J. D. ROLLESTON, M.D. (President of the Section of Epidemiology and State Medicine)

[*April* 26, 1935]

DISCUSSION ON THE PROBLEMS OF PROPHYLAXIS IN PULMONARY TUBERCULOSIS

Dr. A. Salusbury MacNalty : The first step in the prevention of tuberculosis is the recognition of the fact that it is an infective disease. This was known to Galen (A.D. 130-201) and sanitary edicts of the eighteenth century in Spain and Italy enforced isolation of consumptives. But medical doctrine and practice in the early part of the nineteenth century explained tuberculosis as the manifestation of a special constitution or diathesis. So eminent an authority as Sir Thomas Watson was satisfied that phthisis did not spread by contagion. Consumption was rife in military barracks and overcrowded institutions. The treatment of the case—bloodletting, light diets, closed windows, overheated rooms—encouraged the progress of the disease and favoured infection to others. Whole families often perished from it. It was a fatal and widespread disease affecting all ages and all classes of society.

Koch announced the discovery of the tubercle bacillus in 1882. This established tuberculosis as an infectious malady, revolutionized our conception of the disease, and opened the doors to organized research and effective methods of prevention and treatment.

(1) *Methods of immunization.*—On the analogy of other diseases, e.g. typhoid, it seemed reasonable to expect that once the bacillus was identified, a serum or vaccine would be forthcoming which would abolish tuberculosis.

Koch prepared tuberculin in 1890 and since that date a great deal of work has been done on the subject. Countless tuberculins have been elaborated ; allergic manifestations have been described and pondered upon ; immunity in tuberculosis has proved cryptic and baffling. Trudeau, Krause, Baldwin and Gardner and others have endeavoured to obtain an innocuous strain of the tubercle bacillus which might produce effective immunity. The most notable advance in this direction has been made by Calmette and Guérin in the production of B.C.G., but the immunity produced is admittedly transient. Much remains to be done before an effective and safe immunizing agent which shall protect against tuberculosis is likely to be discovered. So far, both dead and living vaccines have produced only short-lived immunity.

(2) *Human and bovine tuberculosis.*—The human type of the tubercle bacillus is the cause of nearly all cases of pulmonary tuberculosis, while, according to Stanley Griffith, at least 5% of human tuberculosis is due to the bovine type. It has recently been shown that bovine pulmonary tuberculosis exists both in Scotland (W. T. Munro and S. Griffith), and in England (W. M. Cumming and W. M. Foster) and its identification is thus of significance in diagnosis, prognosis, and epidemiology. The bovine type of bacillus conveyed in milk is mainly responsible for the infection of man through the intestinal tract. Human tubercle bacilli—e.g. through the hands of a consumptive milker—may occasionally contaminate milk and give rise to tuberculosis through the intestinal tract, but this is exceptional. Non-pulmonary tuberculosis may be due either to the human type or to the bovine type. Griffith has prepared a table showing the proportion of bovine to human infections in different forms of tuberculosis in some 1,300 patients of different ages. It is of interest to

note from this table that tuberculosis of the cervical glands is appreciably a bovine as well as a human infection, and that the higher proportion of bone and joint infections is of human origin.

(3) *The prevention of bovine tuberculosis.*—The prevention of bovine tuberculosis has to be considered from two standpoints :—

(i) The control and possible eradication of tuberculosis in the herds of this country, and particularly in the dairy herds. It is estimated that not less than 40% of the cows giving milk in this country are infected with tuberculosis, and probably between 1 and 2% of milch cows actually yield tuberculous milk.

(ii) The prevention of the spread of the disease to human beings.

As regards (i), considerable progress has been made in recent years. Tuberculosis can be detected in bovines by means of the tuberculin test. Of the three forms of this test used for cattle, the Tuberculin Committee of the Medical Research Council reported in 1925 that the ophthalmic test had been found unreliable, and that under ordinary field conditions the subcutaneous test gave inconsistent results. They devised a modification of the intradermal test, known as the double intradermal test, which has now been made compulsory for the testing of certified herds and has passed into almost universal use by veterinary practitioners. By this method bovine tuberculosis in herds can be readily detected.

Bang, in Denmark, first brought into prominence a method of eradicating tuberculosis from herds which has been extensively and successfully used in America. After tuberculin testing, reactors are removed from the herds and slaughtered, substantial compensation being paid to the stock owners. The cost of this method is enormous. In this country the problem is being attacked by more practicable methods. L. Jordan's report to the Medical Research Council demonstrates the success of an experimental investigation in the eradication of bovine tuberculosis from a selected area in Ayrshire, and W. G. Savage, in his Mitchell lecture in 1933, discussed other measures of eradication.

Another method which is being studied is vaccination against tuberculosis. J. B. Buxton and S. Griffith, at Cambridge, are investigating the efficacy of immunization of calves by B.C.G. (Calmette's attenuated living vaccine) and other antigens. Investigations are also proceeding into the incidence of tubercle bacilli in pastures, the part they play in infecting herds, and possible measures of eradication.

As regards (ii), the prevention of the spread of the disease to human beings, the diminution in non-pulmonary tuberculosis is encouraging. In 1919 the deaths from non-pulmonary tuberculosis (a certain proportion of which were due to bovine infection) were 10,328 ; in 1933 these deaths had fallen to 5,405. Part of the improvement must be attributed to a safer milk supply. The inspection of herds, farms, dairies and milk-distributing centres, the bacteriological testing of samples of milk for tubercle bacilli, and the increasing attention paid to the pasteurization of milk, are measures which must materially contribute to the diminishing incidence of non-pulmonary tuberculosis in the human subject.

It is improbable that tuberculosis is conveyed to any great extent through the consumption of the meat of infected animals, for the reduction in mortality has been very marked during the age-periods in which meat is most largely consumed, and has been coincident in point of time (1851-1910) with a large increase in the general consumption of meat in this country. The cooking of meat is an additional safeguard.

Cream, butter, cheese, skimmed milk, and buttermilk are infective when prepared from milk which contains tubercle bacilli. Margarine blended with tuberculous milk may also be a source of danger.

(4) *The prevention of pulmonary and other forms of tuberculosis.*—For over twenty-one years there has been a National Scheme in England and Wales for the Prevention and Treatment of Tuberculosis. These years of endeavour have effected a great change in the outlook on the tuberculosis problem. The State has realized that tuberculosis is not solely a medical disease which only concerns the patient,

and which receives all the treatment necessary by relegation to the consulting-room of the pulmonary specialist. We have learned that there are a number of complex factors favouring tuberculosis—such as certain kinds of occupation, malnutrition, poverty, overcrowding, bad sanitary environment, contact infection, and the influence of other diseases. The social and biological implications of the disease are also realized, and it is appreciated that all measures directed towards the health and improvement of the nation generally are important contributions towards the prevention of tuberculosis. That is partly why tuberculosis was declining in mortality before the inception of the National Tuberculosis Scheme, and why the School Medical Services and the Maternity and Child Welfare Schemes, through their promotion of infant and child hygiene, help to put the child in a better position as regards both liability to tuberculous infection and powers of resistance to withstand such infection when it occurs. Anti-tuberculosis work is now regarded as an integral part of preventive medicine, and the Medical Officer of Health can marshal and coördinate all branches of the public health service in the prevention of the disease. One great difficulty in prevention continues to face us—that of finding the early case of tuberculosis, and not only the early case, but the primary infecting case in a household or workshop. In this connexion greater attention needs to be devoted to the examination of contacts. Dr. Lissant Cox writes : " We have, in the administrative County of Lancaster during the last twenty years, found that the examination of contacts is a matter of the highest importance."

It must be recognized that the clinical diagnosis of tuberculosis in its early stages is exceedingly difficult ; even for the expert it may require a period of close observation under specially favourable conditions, and preferably in a residential institution. It is often not the practitioner's fault that tuberculosis is for the first time diagnosed and notified when the patient is in a late stage of the disease. "The working man cannot afford to be an early case of tuberculosis," and frequently does not come before the doctor until compelled to do so by sheer physical disability. I was recently shown a patient in whom physical signs and the X-ray picture revealed that every lobe of both lungs contained tuberculous deposits and the sputum was teeming with tubercle bacilli. Yet this patient up to the week previously had been doing a full day's hard manual work and had not realized that he was ill. The public still need to be informed of certain early signs and symptoms of tuberculosis which should impel them to seek medical aid. The Public Health Act of 1925 extended the power of local authorities for educational work in public health. It authorized them to " arrange for the publication within their area of information on questions relating to health or disease, and for the delivery of lectures and the display of pictures in which such questions are dealt with." For these reasons, education in anti-tuberculosis work naturally forms an integral part of the Tuberculosis Scheme of each local authority. The National Association for the Prevention of Tuberculosis, which always works in conjunction with the local public health authorities, renders much help in this direction. In Wales the educational side has been well developed by the Welsh National Memorial Association in its comprehensive tuberculosis scheme. Above all, the National Tuberculosis Scheme depends for its success upon the coöperation of the general practitioners, who form the first line of defence against tuberculosis. Their loyal coöperation and utilization of the specialized services for the benefit of their patients have largely aided preventive measures against the disease.

Another aid to prevention is the widespread diffusion of advances in knowledge. The medical work of the Ministry of Health is intimately linked up with the research work in tuberculosis of the Medical and Agricultural Research Councils. In this way every advance in prevention and treatment and every proved method of therapy are brought to the attention of local authorities and their medical officers. As examples, let me instance artificial pneumothorax and sanocrysin, both of which are now established methods of treatment. Collapse-therapy in its various forms has revolutionized the treatment of those intermediate and advanced cases of pulmonary

tuberculosis which in the past defied successful treatment.   These are not only therapeutic, but also preventive measures, for they diminish the risk of infection.

Another point for consideration, and one which also bears upon prevention, is the difficulty of providing adequate after-care for the consumptive whose disease has been arrested by effective treatment.   His medical supervision is fully arranged for, but his home surroundings and work frequently cannot be satisfactorily adjusted to his physical condition.   This problem has been strikingly solved by Sir Pendrill Varrier-Jones in his pioneer work at Papworth, and by the other Village Settlements at Preston Hall and Barrowmore.   But these settlements can only cope with a minority of the tuberculous population, and not every consumptive is fitted by character or temperament to become a member of them.   Much help can be afforded to individual patients by local care work and by their rehousing in suitable dwellings.

Conclusion.—The mortality from tuberculosis of all forms has declined by 72% in England and Wales since the decennium 1851-60 when reliable mortality figures first became available.   Not only has the mortality fallen, but it has also declined in relation to the mortality from other diseases.   These figures are encouraging, but there is still much to know about the prevention of tuberculosis, hence the great value of a discussion like this.

Dr. Charles Miller: In a discussion on prophylaxis it might be objected that observations on the morbid anatomy of the disease under discussion, are outside the terms of reference.   Morbid anatomy is more easily recognized as essential to the training of the clinician rather than as concerned with the problem of prevention of disease.   Prevention and morbid anatomy are at opposite ends of a patient's career and if there were adequate prevention there would be no morbid anatomy.   Yet there may be some points revealed or made more clear and certain by post-mortem examinations, and these points may have some helpful bearing on the problems of prevention.   I am inclined to doubt if the word " facts " may be used in connexion with our knowledge of disease, but well-supported probabilities are common.   The findings of morbid anatomy are in themselves as close to facts as anything in medicine, but the deductions made from the findings are as much open to question as those made from any other observations.   In all observations human fallibility has to be considered, but if more than one observer comes to the same opinion, the chances of error are lessened.   Statistics, scientifically applied, help to put the proper value on the findings, and as far as possible expert assistance of this kind has been obtained in the present investigation.   But statistics are only applicable to large figures, those of the main divisions of the cases collected.   In the smaller sub-divisions the numbers become too small to justify deductions being made.

In 1908 Calmette and others gave out that as a result of experiment, they concluded that all tuberculosis was infection by ingestion.

At the time, having been engaged and interested in morbid anatomy, I could not reconcile their conclusions with what I had seen in the post-mortem room.   In 1909 I began to collect material and examine it.   From 1914 to 1919 I was absent.   From 1914 Professor H. M. Turnbull continued and directed the work until 1922, further material being collected and examined.   At the later date 800 cases of tuberculosis in children up to the end of 9 years of age, had been collected.   Classification and detailed examination was made and almost completed, when it was thought that a possible error in some cases had been allowed to pass unnoticed.   Further examinations were made of reports and existing material, and further material (140 cases) was collected.   The collection was ended at the end of 1932, chiefly because there was so little material to collect.   Since then the reports of the examinations have been inspected and classified.   A great deal of work remains to be done, but for the purposes of this meeting I have attempted to extract such findings as may have a bearing on the prevention of tuberculosis.

This then is an examination of children of an age up to the end of the ninth year, conducted in the post-mortem room at the London Hospital between the years 1909 and 1932 inclusive. Obviously it is not claimed that the figures of this investigation represent any other place than the East End of London during a particular period 1909 to 1932. Further, in this period many changes have taken place in the district and in the hospital population. Also the number of post-mortem examinations is a little more than half what it used to be. A yearly total of over 1,000 cases was the rule. Now from 500 to 600 is what is obtained.

But post-mortem examinations on tuberculous children of this age have fallen from 106 in 1909, to 8 in 1931 and 1932.

The total number of subjects examined was 5,259, males 3,028, females 2,231. Of these, 419, males 218, females 201, were stillborn or died at birth. There was no evidence of tuberculosis in these 419.

The number of children born alive was 4,840: 2,810 males, 2,030 females. Among these 4,840 were 940 cases of tuberculosis; males 528, females 412—a percentage of 17·8%. From 1909-1922 the percentage was 21% in 800 cases, and from 1923-1932 it was 10·9%—just about half of that in 1909-1922, though it has to be remembered that the number is small. Of the 940 cases, 677 were undoubtedly respiratory infections. Almost certainly an additional 14 cases which were classified as "double infection" should be added, making 691 cases of primary respiratory infection. Possibly among the earlier examinations some of the abdominal infections were instances of swallowed infective material from a pulmonary lesion that escaped notice. 218 cases were cases of alimentary infections and 21 of primary infections of the common respiratory-alimentary tract, i.e. from the lips to the epiglottis. The youngest subject was 3 weeks old, and the next 8 weeks old. Both had tuberculous infections of the lung.

There are two chief routes of infection, one by the respiratory and the other by the alimentary tract, and the former outnumber the latter by more than three to one. Only one other route of infection need be noticed, the common respiratory-alimentary tract. There were 21 cases in this group. The number is small, in view of the large numbers of children with so-called tuberculous cervical glands, who were to be found in surgical clinics. But examples of tuberculous infection through the common respiratory-alimentary tract are extremely rare in post-mortem examinations of all ages. The explanation of the discrepancy must be speculative, and cannot be considered here. It is to be noted, however, that this method of infection can occur early in life. In the first 800 cases there were 4 cases between the third and twelfth month, 2 cases in the second year, 4 in the third year, 3 in the fourth year, none in the fifth and sixth years, 1 in the seventh, 2 in the eighth, 1 in the ninth, and 3 in the tenth.

Further, in the supplementary 140 cases collected since 1923, 3 cases only have been found, all early in life, 1 in the second and 1 in the fourth quarter of the first year, and 1 in the first half of the second year. There were also 5 cases of apparently double independent infections of the common respiratory-alimentary and separate alimentary tracts, 2 occurring in the first year.

It can be said that the infection of the common respiratory-alimentary tract can take place as early as the fourth month, and there are more cases in the first year than in any other.

1st year	...	...	6	cases	⎫
2nd ,,	...	...	3	,,	⎬ 13 cases in the first three years
3rd ,,	...	...	4	,,	⎭
4th ,,	...	...	3	,,	
5th ,,	...	...	0	,,	
6th ,,	...	...	0	,,	
7th ,,	...	...	1	,,	
8th ,,	...	...	2	,,	
9th ,,	...	...	1	,,	
10th ,,	...	...	3	,,	

There remain for consideration the largest and most important groups—the respiratory and alimentary. Between them they total 895 cases, or if the fourteen additional cases already mentioned are regarded as respiratory, 909 cases out of 940.

The remaining ten cases comprise double infections in which it was not justifiable to say that one lesion was older than another, one case of infection by the skin, and one case which had to be labelled "route unknown."

We can now direct our attention exclusively to the respiratory and the alimentary infections. When the relative activity, degree of extension, and mortality by the different routes are compared, infection by the respiratory tract is found to be definitely more active and progressive, more extensive, more likely to cause hæmatogenous dissemination, and more often lethal, than infection of the alimentary tract.

Infection by the common respiratory-alimentary tract occupies an intermediate position, either when examined by itself, or when the doubtful double infections by the respiratory-alimentary and alimentary tracts are added. This may indicate that infections by the respiratory tract are caused by bacilli more virulent than those which usually infect the alimentary tract. On the other hand the difference may depend essentially upon anatomical peculiarities in the different areas which are primarily infected. A decision between these alternatives would be of great practical as well as academic value. The method of investigation is, unfortunately, incapable of affording a decision but it does show that infection by the respiratory tract is more serious than infection by the alimentary tract, and this is a conclusion of great practical importance. In a few cases the type of bacillus was determined, in some by Dr. A. Stanley Griffith, and in others by Dr. Paul Fildes. The results were those usually obtained. The human type was found in the respiratory group and the bovine in the alimentary group. In one respiratory infection both types were present.

Even if the indirect anatomical evidence is regarded as valid, it does not prove that human bacilli are more virulent in the accepted bacteriological sense; it may only mean that, owing to anatomical peculiarities, infection of that portion of the body to which human bacilli usually gain entrance is more serious than infection of the portion of the body which is specially exposed to bovine bacilli.

In other words, infection of the lung with human bacilli is more serious than infection of the intestine with bovine bacilli.

If we consider the first ten years of life in periods, we find that the prevalence of tuberculosis, irrespective of the special path of infection, increased steadily in the first five years, and after that the value remained approximately constant. The prevalence of infections by the respiratory and alimentary routes each behaved in a similar manner, showing a constant level in the second five years.

It is difficult to compare the virulence of infections by different routes. In animal experiments the virulence of an infection can be gauged by its persistence, extension, rapidity of extension, lethal effect, and rapidity of lethal effect. In an examination of human necropsies the time-relations, obviously, cannot be estimated with any accuracy. Some idea of the relative persistency of infections can be obtained by estimating the activity of the infection in each case. Infections which have become inactive can be determined by inoculation experiments, but few of such experiments have been possible. In the records there is ample evidence that all caseo-calcareous lesions cannot be accepted as inactive. Therefore, calcareous or completely fibrous lesions have alone been regarded as " probably inactive." All other lesions have been considered active. All ulcers which have not healed completely have been regarded as " recently progressive."

In estimating the age of a tuberculous lesion certain criteria were used as uniformly as possible. Thus calcareous lesions were regarded as the oldest, and completely fibrous lesions were classified as next in age. In both of these lesions there was a less expectancy of activity than in others.

Calcareo-caseous, fibro-caseous, and caseous lesions, especially those that could be called " caseous areas," came next ; and earliest lesions were those of miliary tuberculosis whether caseous miliary tubercles or miliary granulomatous tubercles, the former possibly being a little older than the latter. The size and character of a tuberculous lesion depend not only on the duration of its existence, but on the character of the tissue on which it is deposited. In this respect the importance of the lymphatic tissue is very great. In children tuberculosis of the glands is nearly always a prominent feature. It is not that they are primarily infected, though it is impossible to deny the possibility of a primary infection. In the cases of respiratory tuberculosis where there is extensive caseation of hilar, bronchial, and paratracheal glands, an older and apparently more trivial lesion can often be found in one of the lungs. But to the child, the glandular tuberculosis is the greater source of danger, for a caseous gland is commonly the infectious predecessor of an intimal tubercle of the pulmonary vein, the starting-point of a blood dissemination, or the caseous hilar glands may spread tuberculosis by the lymphatic path back into the root of the lung, producing a secondary pulmonary tuberculosis. Or, again, a caseous gland may ulcerate a bronchus and produce a massive tuberculous bronchopneumonia by aspiration. The starting of such serious troubles may be a small insignificant-looking area of tuberculosis in another part of the lung. Among the respiratory cases, infection of the glands is very common in the earlier years. Later in the series there are more cases in which the lung is affected and the glands escape.

In the alimentary cases, it is common to find tuberculous mesenteric glands without a visible tuberculous lesion in the intestine. In that series of cases there is no instance of a visible tuberculous intestinal lesion without infection of mesenteric glands, and in many the glandular lesion appears to be much more remarkable than, and disproportionate to, the intestinal lesion. In cases of hæmatogenous dissemination the development of the blood-borne tuberculosis is much more rapid in lymphatic tissue than elsewhere. Thus the tubercles of the spleen are larger and more densely packed than those of the liver and kidneys, and recent ulceration of Peyer's patches and solitary follicles in general dissemination is much easier to find than lesions of the mucosa of the stomach and the intestine. It will be recognized then that in young children lymphatic tissue is very vulnerable to tuberculosis and is the site of more extensive and more rapidly enlarging deposits than other tissues. But it is probable that there is a primary focus elsewhere from which lymphatic tissue is infected. Evidence of virulence is also given by the lethal effect or mortality of infections. It was impossible to compare the degrees to which tuberculosis contributed to the cause of death in each case ; indeed, it was impossible in many cases to decide whether the tuberculosis had had any influence or not. It was possible, however, to recognize cases in which tuberculosis was either the proximate cause or was a remote cause without which the proximate cause would not have arisen.

Cases in both categories would have to be included in an estimation of the mortality of tuberculosis. But when cases in the second category are examined there are many which cannot be accepted as giving evidence of exceptional severity of infection. In four cases death was due to strangulation of the intestine by a fibrous adhesion between the peritoneum and a tuberculous mesenteric gland. These cases indicate a mortal issue to which infection of the intestine is more likely to lead than infection by the lung, but they do not afford evidence that the type of infection which affects the intestine primarily is the more virulent. In such cases the infection may have ceased long before the mortal accident, and in only one of the four cases was there any evidence of recent progression of the tuberculous inflammation. In these cases the mortal issue was due to an accident of the position and the form of the inflammatory reaction and not to the exceptional severity of the infection.

Again, examination of the cases in which sudden death followed accidents

showed that in many the tuberculosis had to be regarded as a remote cause, without which the accident would not have occurred. There are 60 cases of death within twenty-four hours of an accident. In 11 a recent partial dissemination of tuberculosis had preceded the accident; the child could be regarded as prone to accident because of illness. Again, curvature of the spine may cause failure of a hypertrophied right heart, and though a tuberculous condition was responsible for the disorder of the heart, it was only indirectly a cause of death. Hæmatogenous dissemination is also a matter of the position of a particular focus, the occurrence of an intimal tubercle in the neighbourhood of a caseous gland. Further examples can be found to illustrate the difficulty of attributing death to tuberculosis among the tuberculous.

Summarizing the findings of this investigation, it can be said that respiratory infections out-number all other regional infections; alimentary infections come next, and the region of the pharynx is a bad third. Possibly an investigation among living children would yield a different order. Children infected by the respiratory tract are more likely to die, and the younger they are, the less chance they have of living. Those infected by the alimentary tract seem to have a better chance of living and the older they are the better is the chance. It is remarkable that the number of post-mortem examinations of tuberculous children has decreased so greatly, but it does not do to attach too much importance to this decrease as many factors may be responsible for the change. But while the total decrease is great, the relative decrease of alimentary cases in the later years of the period under observation is even more remarkable.

Would it be justifiable to attribute the decrease of alimentary cases to some change in the feeding of children? Such a conclusion may not be permitted to a morbid anatomist and I have no intention of claiming the right to it, but it is suggestive.

As a result of this investigation in morbid anatomy, it may well be asked, " What has been learned that has a bearing on prevention of tuberculosis in childhood ? " The answer must be, " Not very much that was not known before." But there is some value in bringing support to views already in existence. Whatever may be our individual and collective views as to the right way of tackling the tuberculosis problem, seeing the end-results in the infected individual may help to give us confidence in the measures to be taken to prevent these results. Whether we think environment important, or eugenic principles the key to the solution, we still have to consider the tuberculous child and how the infection of the child occurred, and, therefore, by the lessons of morbid anatomy we can learn how to prevent other children from being infected in the same way. If the figures for the incidence and mortality of tuberculosis in this country show a decrease during the last twenty years, it can be said that the figures of this examination are in agreement with them. But the figures are those of a special population in a particular locality and cannot be taken as representative of the rest of the country. Certain points, however, stand out as being important. First, children are not born tuberculous; tuberculosis is given to them. Next, respiratory tuberculosis may be regarded as a frequent disease of infants and may occur very early in life. Further it is very fatal.

Alimentary tuberculosis appears a little later in life; it does not show signs of activity and virulence to the degree seen in the respiratory cases. Many of the non-lethal cases, incidentally, are alimentary infections.

In all infections by tuberculosis we can say that the younger the child, the more serious is the prognosis. The figures show the greater prevalence and greater seriousness of the respiratory infection. We can argue then that the danger to a child is the presence of a consumptive individual in the child's environment. It is possible for adults with open tuberculosis to live with young children without infecting them, but much depends on the conditions and on the willingness of the

adults to be trained. These conditions are found in certain colonies of tuberculous subjects where environment and training are under constant skilled observation. Tuberculous milk and probably other food, is a danger and a considerable one. Much attention has been paid to robbing milk of its dangers, and though dirty milk can still be bought, clean milk can be had at a higher price, and dried milk is clean and in common use.

We read and hear more about the purification of milk supplied to children, than of other potent causes of infecting them with tuberculosis. It is obviously easier to exercise control over the milk supply than over the habits of tuberculous individuals, for their cases may not have been diagnosed or they may be unable to understand the character of their disease and the way infection can be spread.

Lastly, though we should not slacken our efforts to lessen the supply of tubercle bacilli in a child's environment, it would seem that the tuberculosis problem is gradually solving itself to a great extent, possibly owing to better conditions or increasing immunity, and our efforts are helpful and not radical, but none the less important and necessary.

Dr. D. A. Powell: For all practical purposes, every case of pulmonary tuberculosis originates from another case with a pre-existing open pulmonary lesion from which tubercle bacilli of the human type are extruded into the outside world.

The fact that tubercle bacilli are innumerable and ubiquitous does not mean that the number of their effectives cannot be controlled by direct methods, and the present tendency to lay stress on the soil rather than the seed should not blind us to the supreme importance of those measures which aim at reducing the amount of inoculum at large to proportions manageable by those who may be brought into contact with them.

These measures may be summarized as follows :—

(1) *The diagnosis and treatment of pulmonary tuberculosis while still in the closed stage.*—While the really early case will rarely be found—pending regular medical surveys of the whole population—except by a thorough and prolonged follow-up of contacts to open cases, there is little excuse, in these days of X-rays, &c., for postponing diagnosis until the sputum is positive.

(2) *The intensive search for occult cases.*—Everybody recognizes the importance of looking for post-primary cases, but ante-primary cases should be sedulously searched for as well. Quite commonly these cases are silent; the patients are not ailing, and there is nothing to draw attention to them, or if they are ailing, their disease escapes recognition under another diagnosis, such as chronic bronchitis.

(3) *The conversion of known open cases into closed* by treatment, either directly, by collapse methods, or indirectly, by general sanatorium methods.

The day, not far distant we hope, when thoracic surgeons will be able to obliterate cavities with safety, certainty, and despatch, will be a great day for patients ; it will be an even greater day for the community.

(4) *The personal precautions that should be taken (i) by the patient*—e.g., care in coughing, in the disposal of sputum and sputum-contaminated articles, *and (ii) by others*, especially (*a*) the disinfection, or rather the super-cleanliness, of clothing, utensils, rooms ; (*b*) The complete or partial isolation (or zoning) of the patient at home and at work. This may involve the removal of contacts, especially children, out of the effective radius of infection ; a change of occupation, e.g. in the case of teachers, etc.; (*c*) the segregation of patients in institutions.

To deal with segregation first. As a well-known Canadian authority has said— the very foundation of all anti-tuberculosis measures is *beds*.

This was demonstrated statistically by Drolet when he showed that there is a striking correlation between tuberculosis hospitalization and mortality in different

countries, those with the lowest death-rate having the highest number of beds per 100 deaths, and vice versa.

The accommodation (subject to allowance for special local conditions) which the Joint Tuberculosis Council recommends, is the *one-to-one standard*, that is, one bed per death per annum ; better still would be one bed per pulmonary death per annum. The actual figures for England and Wales (1932) vary enormously with different local authorities from about 30 to 122 beds per 100 deaths ; the ratio, for all England, of *all* tuberculosis beds (including those in Public Assistance institutions) to 100 deaths from tuberculosis, all forms, being 93·2 : for Wales 69·4. The ratio of *pulmonary* beds to 100 deaths from tuberculosis (all forms) was England 71·7, and Wales 49·8 ; non-pulmonary beds to 100 deaths being, England 21·5, Wales 19·6.

Of every 100 beds so provided, 75 should be ear-marked for pulmonary patients, and in my opinion only the intractable residue of cases should be retained in Public Assistance institutions.

The paramount importance of the segregation of open cases is apt to be lost sight of in these days—it has never been realized in some quarters—but the fact remains that its utmost possible use is the most effective method of prophylaxis. It is the most logical, ultimately the cheapest, and the most expeditious way of attaining our object.   Until waiting-lists are a thing of the past, we have not really got to grips with the problem of prevention. The concentration in institutions of reservoirs of infection must have played a major part, even with our present provision, in reducing the doses of available inoculum to subliminal proportions for an increasing number of the population.

In all this welter of talk about "exogenous" and "endogenous" infection, it behoves us to remember that *all* infection is exogenous—to start with.

It is true that the variable and protracted course of the disease, the tenderness of public sentiment, and the expense, make the ruthless enforcement of segregation impossible, even if it were desirable, but we ought to have enough beds to accommodate every patient who is willing to go in, and to keep him there until he is rendered non-infectious, or hygienically safe through training, or until death occurs, or until he is absolutely fed-up, in spite of all that intelligent treatment, the provision of every reasonable amenity, and the mitigation of home difficulties can do.

Our institutions should be live institutions, so constructed, so situated, so well founded, staffed, and equipped, that patients will be eager to go into them and only too anxious to stay until they are discharged.

Disinfection.—It would be well if our laggard sanitary authorities would emphasize the fact that (in regard to tuberculosis) super-cleanliness is an admirable substitute for the disinfection which they ought to be carrying out ; involving only the scrupulous observance of common-sense precautions, which differ only in degree from the ordinary rules of every clean, self-respecting individual.

The precautions necessary may be summed up as follows : In a pulmonary case, care with regard to the sputum ; in a surgical case, care with regard to the discharge. A pulmonary case without cough or sputum is non-infectious, and a surgical case without a discharging sinus is non-infectious.   Care with regard to the sputum consists of :   (1) Collection, sterilization by boiling, and disposal of the sputum itself ; (2) surgical cleaning of all articles which may be contaminated by sputum or saliva ; (3) prevention of droplet infection.

Sputum and all sputum-contaminated articles should be kept moist until they can be sterilized or destroyed. For rooms, corridors, &c., used by the patient, frequent cleaning with soap and water is all that is required.

The technique, reduced to its utmost simplicity, that is necessary to observe these precautions should not only be explained, but demonstrated in practice by nurses and health visitors, again and again, at the patients' homes, until it has been thoroughly grasped by the whole family.

The need to *zone* the patient, as far as possible, by seeing that he has a bedroom to himself, even if this involves providing a shelter, not for him, but for his contact, by ear-marking his own personal belongings, and by avoiding intimate contact with his children, should also be stressed constantly.

That brings me to my last point. These methods of personal prophylaxis should be taught intensively and practically to patients, concurrently with the later phases of their treatment in an institution.

The distribution of a leaflet, or an occasional lecture by the medical superintendent, is not enough. Patients leaving a hospital or sanatorium should leave not only with reserves of resistance, but armed with the knowledge and adaptability to resume their place in the world without serious detriment to themselves or danger to others.

After all, the conditions of life in an institution are wholly foreign to a patient's normal life, and the transition to home conditions and domestic difficulties is too great and too abrupt, and should therefore be tempered by a course of training in post-institutional life. This can be carried out most effectively by reproducing at the sanatorium as nearly as possible, typically bad home conditions, and teaching patients by precept and practice how to make the best of them.

What is called the Cottage Scheme at the North Wales Sanatorium for Women, was started ten years ago to fill up a serious gap in the anti-tuberculosis campaign. An old barn was converted into three typical Welsh cottages and equipped at a capital cost of £310 each, and a trained domestic science mistress who had a thorough knowledge of cottage life was appointed. She was, first of all, herself taught the special hygiene of the consumptive and the consumptive's home. A minutely detailed syllabus of instruction was drawn up, consisting of a period of class-teaching, followed by residence in the cottages.

The class-instruction is oral and practical, and consists of a course of budgeting, marketing, dietetics, cooking and washing, with, concurrently, a special course in personal prophylaxis, the fullest details being given and carried out practically by the patients themselves, as to the disposal of sputum, the surgical cleansing of sputum-or saliva-contaminated articles, e.g. cutlery, crockery, handkerchiefs, pillow-cases, sham slip-sheets, &c., the cleaning of rooms and corridors, and the prevention of droplet infection.

Later the patients are sent to live in the cottages for, on an average, five weeks (eleven patients are always in residence). There they carry on, under supervision, the ordinary cottage life to which most of them will return, and apply the lessons they have already learned. They are shown how to make the best of a bad job, how to bring their cottage, so far as this can be done without expensive and extensive structural alterations, into the best hygienic conditions possible; removing sandbags and opening windows; taking down curtains, ornaments, valances; removing carpets and excess furniture; rubbing-down walls and scrubbing floors. They are taught how to look after themselves and safeguard others when they return home; when to rest, where to rest, and how to rest; to be careful with regard to excretions. They are taught the difference between draughts and ventilation, and between cleanliness and surgical cleanliness, and are told when the former will suffice and when the latter is essential. They sterilize their own clothes, do their own washing and cook for themselves nutritious, economical meals provided only with the ordinary facilities of the ordinary home. They are shown that the worst cottage has one good side— the outside—and are taught to live on that side for both their work and their recreation. In a word, they are taught to realize that "what is in the head, not what is in the lungs, determines their outlook" and that of their families.

How does it work? Dr. Fenwick Jones, the Medical Superintendent, who has always taken the keenest personal interest in the scheme, reports that 841 patients have passed through the cottages since 1925 at an average cost of 11s. 8d. per head

per week, which covers all expenses, including the cost of food and cleaning materials bought at the sanatorium at prevailing retail prices, coal and rent at 5s. per week per cottage. Competition is keen, but proper rests are insisted upon and no economizing in food is allowed.

The patients are unanimous as to the value of the training, and many useful hints have been learned from them. Their weight, general condition, and morale continue to improve, although the amount of work they do is more than they perform even in the highest outdoor grades, and has a much greater appeal to the average woman.

They frequently express their surprise and joy at being able to perform ordinary routine household work, which many say they would not have attempted, or have been allowed by their relatives, to resume, after discharge, had it not been for their cottage experience.

The importance of avoiding the infection of others is brought home to the trainees at every turn. They themselves sterilize and wash everything, except blankets, sheets, and mattresses.

They are repeatedly told : " Carry the cottage home with you ; do there as you are doing here ; look after your sputum ; look after yourselves ; look after your own things ; keep all your relations—and not only your in-laws—at arm's length."

Dr. Fenwick Jones says that in his opinion the Cottage Scheme is the most valuable part of the sanatorium and makes it what it ought to be—pre-eminently the place for teaching prevention.

I feel sure that if such a training became general in our institutions (and suitably modified, the course is equally applicable to men), the results of treatment would be more lasting, the number of return cases less and the percentage of post-primary cases would materially diminish. In addition, the general diffusion of the knowledge, practically acquired, that the laws of health are easy to learn and not too difficult to practise, would in time be reflected in our morbidity and mortality tables.

Dr. G. Gregory Kayne: The title of this discussion cannot be assumed to indicate that in children the problem of the prophylaxis of pulmonary tuberculosis can be dealt with as distinguished from that of other forms. It would constitute a difficult and invidious task. Perhaps it implies the acceptance of the conception that tuberculous infection or disease in children is a precursor of pulmonary tuberculosis in adults. I propose, therefore, to use the time at my disposal to discuss the prevention in infants and children of tuberculosis as a whole. Unfortunately, important gaps still exist in our knowledge of cause and prognosis. Ignorance of the role played by heredity must be stressed in particular. Efforts and money are perhaps wasted on individuals whose natural defences enable them satisfactorily to overcome the infection, instead of being concentrated on those most vulnerable to the tubercle bacillus. The work of the French school who consider tuberculosis in childhood merely as mathematical variations of age and dosage is not entirely devoid of error. On the other hand, the existence of the filtrable form of the tubercle virus is still a matter for debate, " evident congenital tuberculosis "[1] is rare, and other infants inheriting tubercle bacilli probably die soon after birth of prematurity or debility. While heredity can thus be excluded as a cause of tuberculous *infection*, in the form of natural immunity, a diathesis, or a specific predisposition, it may be an important factor in the development of *disease*. I should like, therefore, to draw attention to the work on twins by Diehl and von Verschuer (1933) who favour the theory of an inherited specific predisposition, and that of Ickert and Benze (1933) whose careful genealogical study suggests the transmission of this predisposition as a recessive factor. In the present state of our knowledge, however, prevention can only be based on two principles applicable to all children : (1) the

[1] A term suggested by the speaker for applying to infants born with macroscopic tuberculous lesions, and corresponding to " tuberculose congénitale avérée " used by French authors.

avoidance of infection, i.e., of contact with tuberculous contagion, whether of human or bovine origin; and (2) the increase of the child's general or specific resistance.

In view of the ubiquity of the tubercle bacillus, avoidance of contact for an indefinite period is clearly impracticable, but the greater susceptibility of the infant as compared with older children indicates its value when carried out even for a short period only. In England the danger from bovine sources has been sufficiently emphasized and discussed. I shall merely refer to the impression existing amongst clinicians abroad (e.g. in France and Spain) that bovine sources are negligible, owing to the national custom of boiling the milk.

TABLE I.—DEATH-RATES

		Per 1,000 live births	Per 1,000 living		
		Under 1 year	1-5 years	5-10 years	10-15 years
1911-15	All causes	109·56	16·21	3·39	2·08
	Tuberculosis (all forms)	3·08	1·64	0·6	0·59
	% of tuberculosis to all causes	*2·8*	*10·0*	*17·6*	*28·3*
1916-20	ditto	89·94	14·58	3·81	2·48
		1·99	1·39	0·61	0·66
		2·2	*9·5*	*15·1*	*26·6*
1921-25	ditto	76·05	10·29	2·48	1·71
		1·39	0·98	0·38	0·43
		1·8	*9·5*	*15·3*	*25·1*
1926-30	ditto	67·88	8·58	2·37	1·58
		1·07	0·80	0·31	0·33
		1·5	*9·3*	*13·0*	*20·8*
1931	ditto	66·35	7·52	2·14	1·47
		1·05	0·67	0·26	0·27
		1·5	*8·9*	*12·1*	*18·3*
1932	ditto	65·04	6·94	2·07	1·39
		1·00	0·68	0·24	0·25
		1·5	*9·8*	*11·5*	*17·9*
1933	ditto	63·68	6·56	2·19	1·43
		0·83	0·59	0·22	0·24
		1·3	*8·9*	*10·0*	*16·7*

Mortality in 1933 expressed as percentage of mortality in 1911-1915

	Under 1 year	1-5 years	5-10 years	10-15 years
All causes	58	40	64	68
Tuberculosis (all forms) ...	27	35	36	40

The danger from human sources—well recognized and extensively studied abroad—has perhaps not attracted adequate attention in this country. Yet, in the Report of the Special Committee appointed by the People's League of Health (1932) it is estimated that 75% of the tuberculosis deaths in children under 15 are due to the human bacillus. Blacklock's (1932) long and painstaking work in Scotland showed that 73% of strains isolated from children dying as the result of tuberculosis were of the human type. Stanley Griffith (1934) found the percentage of human bacilli in 188 cases of meningitis to be 75: 60% in the Scottish, and 78% in the English cases. In Table I are indicated the death-rates from all causes and from all forms of tuberculosis in children under 15 since 1911. The deaths due to tuberculosis are also given as a percentage of the total deaths. There has occurred a gradual fall in the death-rate both from all causes and from tuberculosis at all ages. The figures in the lowest two lines show the percentage death-rate from all causes and from tuberculosis in 1933 as compared with 1911-15. The tuberculosis mortality has dropped considerably more than the general mortality at under 1 year, at 5 to 10 years, and at 10 to 15 years, but not at 1 to 5 years. As many of the infants infected in the first years of their life die in the second year, the figures appear to indicate that the drop in tuberculosis mortality in children under 5 years is due to measures for improving the health in general, rather than to efforts directed against tuberculosis itself. Thus, while at 1 to 5 years, tuberculosis accounted for

10% of all deaths in 1911-15 and 8·9% even in 1933, at 5 to 10 and 10 to 15 years the respective percentages were 17·6 and 28·3 % in 1911-15, but only 10 and 16·7% in 1933.

TABLE II.—DEATHS FROM TUBERCULOSIS (ALL FORMS)

(*England and Wales*)

(1933)

Age			Number of deaths
Under 1 year	...	...	482
1 year ...	...	...	569
2 years ...	...	...	337
3 ,, ...	...	...	297
4 ,, ...	...	...	203
Total: under 5 years	...	...	1,888
,, 5 to 9 ,,	...	...	697
,, 10 to 14 ,,	...	...	827
Total under 15 ,,	...	...	3,412

Actual numbers have their own interest. Table II gives the tuberculosis deaths (England and Wales, all forms) for 1933—the lowest mortality so far recorded ; yet there were still 1,888 deaths under the age of 5, and 3,412 under the age of 15. And it will generally be admitted that errors of certification will here tend to favour under-estimation rather than over-estimation of the correct numbers. Three-quarters of these deaths are due to human contact. The tuberculosis mortality is well known to be very much higher amongst home-contacts than non-contacts. A fatal case of tuberculosis is more likely to be due to a massive dose of contagion, and therefore one met in the home. And lastly, the infant and very young child, at any rate, live chiefly within the home environment with few opportunities for chance infection. The last three facts indicate that most of the deaths quoted, especially in infants and young children, have probably occurred amongst home-contacts.

Two years ago, in a stirring article, Professor Lyle Cummins exposed the inadequacy of our measures for dealing with home-contacts. He showed the need for the appointment of "child-contact officers" and the establishment of certain institutions for the children, and asked for the preliminary organization of a "demonstration" unit on these lines.

Are all our authorities really satisfied with their methods of dealing with home-contacts ? It is significant, in spite of the fact that tuberculosis still accounts for 10% of the deaths at 5 to 10 years, and 17% at 10 to 15 years, that not one of the over 100 investigations undertaken by local education authorities (quoted in the 1933 report of the Chief Medical Officer of the Board of Education) has dealt with tuberculosis under any of its aspects.

Primary infection in children can only be accurately studied if the children are kept under observation and fully investigated from before the stage of symptoms or onset of tuberculin hypersensitiveness. Studied in this way—as Wallgren has shown—primary tuberculosis appears to be an infectious disease with an incubation period, prodromal symptoms, and often a typical clinical syndrome. Of very great value is Wallgren's recent contribution to its prognosis. I quote extracts from his paper read at the Annual Meeting of the American Academy of Pediatrics in 1934.

" It is evident that, with only few exceptions, tuberculous meningitis develops as a complication to fresh, primary tuberculosis." " . . . the child runs the greatest risk of getting meningitis between the fourth and the eighth week after the appearance of tuberculin sensitivity. Once three months have passed, the danger of meningitis is considerably less." " . . . the danger of meningitis is infinitely greater if a child is infected during its first three years of life than later." " Uninfected children, in particular, must be protected against infection during the late winter and early spring. . . ."

It appears, therefore, that during the first three months after the occurrence of the primary infection, measures should be taken to influence its further course.

Wallgren states that sanatorium treatment or supervised hygienic measures in the home, during this period, in 428 children was followed by three cases of meningitis only. On the other hand, of 23 children with tuberculous meningitis in whom the date of the primary infection could be ascertained, only three had had the above treatment—in four others, however, the symptoms of meningitis appeared too rapidly for treatment to be instituted.

In view of what I have stated, it is hardly necessary to emphasize the point that the discovery of an active case of tuberculosis compels the immediate and energetic handling of the infants and children in the home of the patient. Avoidance of contact does not necessarily imply removal of the child from home. Adequate treatment of the patient is the first essential. Sufficient institutional accommodation should therefore be available to secure immediate admission. Effective artificial pneumothorax does much to reduce the amount of infectious material, but absence of expectorated sputum is not tantamount to non-contagiousness, as the search for bacilli by gastric lavage is showing. The importance of recent developments in collapse therapy, especially in bilateral cases, cannot be over-estimated, as they enable the cure of very chronic cases, probably of the longest potential danger to children. Finally, our duty to children demands that we should make fuller use of the powers given by Section 62 of the Public Health Act of 1925 to segregate advanced contagious patients.

The second step must always be consideration of prophylactic hygienic measures in the home. No parents are so unintelligent as not to succeed in effecting some reduction of contact of the children with contagion in the home, if a competent and patient individual will take the trouble to attempt the teaching. The work in the village settlements in England and that of Heynsius van den Berg (1929) amongst dispensary patients in Amsterdam, shows what can be accomplished in this way. In the classes from which most of our tuberculosis patients are obtained, however, adequate measures in the home are not always possible, and it is advisable to remove the children from the home for shorter or longer periods, while the contagious person is living in it. The so-called " Grancher system " is, by name at any rate, known to many. I have dealt fully, in a report to be published shortly, (*Tubercle*, July-October 1935), with the existing methods of separation. They are extensively practised in France, Belgium, Sweden, and Norway, and also in Canada. Critical examination of the results does not always substantiate the claims made, and I was led to the following conclusions :—

(1) Separation of an infant or child from its tuberculous parent (or other relative in the home) before infection has taken place (as determined by a tuberculin test, due allowance being made for the ante-allergic period) will prevent the occurrence of tuberculous infection—and therefore disease—provided the child is placed in a non-tuberculous environment.

(2) Separation of a home-contact under the age of about 2 years, once infection has taken place, is of possible value in the prevention of tuberculous disease, and should be carried out until more is known on the subject, but a thorough investigation, including a period of observation, is essential to exclude tuberculous disease *before* separation is effected.

(3) Separation of a child over about 2 years of age, already infected, is of doubtful value in the prevention of tuberculous disease, considered merely from the point of view of removal from contagion, but it is useful if the hygienic environment to be obtained thereby is greatly improved.

(4) In considering the separation of a home-contact, not only the avoidance of contagion and the question of improved environment must be kept in mind, but also the child's future in the case of the mother's or both parents' death.

(5) The general mortality of infants boarded out in families, even under very strict supervision, is higher than the general infantile mortality. Separation in

institutions, provided these admit only healthy infants, attended by a staff not coming in contact with sick children, is preferable.   For older children, boarding-out in families has distinct advantages.

(6) A complete anti-tuberculosis scheme should include available organizations for both familial and institutional separation.   These schemes should adopt a widely regional character as otherwise the number of eligible children may be too small for satisfactory working.

In discussing removal of a child from home in England, sentimental considerations come much to the fore.   Miss Broadbent, referring to the " Grancher system " at the 1931 Conference of the National Association for the Prevention of Tuberculosis, said :—

" It has, I believe, been tried in other countries besides France, and has been carried out with an element of compulsion, which may seem reasonable when public money is being expended, but is foreign to the English temperament.   The plan adopted by the L.C.C. depends upon persuasion, and it is a singular fact that, with all the advantages which it offered to the parents, comparatively few children have been sent away under it."

Dr. Letitia Fairfield, at the same Conference, in speaking of the L.C.C. scheme for home-contacts, said :—

" The children do very well, but the scheme is gravely interfered with by lack of coöperation on the part of tuberculous parents, as many other persons have found.   I think we do not make a sufficiently direct appeal to parental responsibility in our tuberculosis progaganda, and we treat parental feeling in its more selfish manifestations with too great respect.   Parental love responds to appeals to heroic virtues, but not to half-hearted suggestions which leave the real issues obscured."

I suggest that it would be valuable to have a detailed report of the working, medical results, and administrative or other difficulties of this L.C.C. scheme, which has now been in force for ten years, has dealt with over 2,000 children, and yet appears to be comparatively little known.

The second principle in prevention is the raising of the child's immunity.   I need not discuss general measures, to which I have already referred in speaking of Wallgren's work on meningitis.   Discussion of specific immunity leads to consideration of B.C.G. vaccination.   I have had the opportunity of studying this subject in various centres in Europe for eighteen months and recently read a paper before the Tuberculosis Association in London on February 15, 1935, from which I will quote conclusions.   B.C.G. is innocuous in man, but it is not a *virus fixe*, and its effect appears to vary with the artificial medium on which it is subcultured for long periods.   Work in Copenhagen, where a method for measuring small differences in the effect of B.C.G. has has been evolved, may shortly lead to obtaining a vaccine of more or less constant strength.   This is the first essential in the use of the vaccine over a period of years.   The readiness with which B.C.G. tends to die makes it advisable to use the vaccine within a day or two of its preparation.   While the oral method of administration must still be considered in those countries in which the amount of tuberculosis and lack of other anti-tuberculosis measures favour mass-vaccination, in England, at any rate, the intradermal is the method of choice.   Separation from human contagion until the appearance of a positive tuberculin reaction is definitely necessary, but this does not imply removal from home of all, or even most, children, as the measures now available should enable the removal of the contagion from the home or the institution of prophylactic hygienic measures in it.   If separated, the child should be returned to the tuberculous environment as soon as tuberculin-positive, in order to meet the first virulent infection at the optimum phase and increase the partial immunity which B.C.G appears to produce in man, apparently for from six to twelve months, at any rate when used by routes and in dosages now practised.   Home-contacts only should be vaccinated and

this applies to all non-infected infants and children. B.C.G. can only be expected to turn the scale in some individuals at their first infection, and it is effective only if combined with the other methods of prophylaxis which I have discussed.

While advocating the use of B.C.G. in this country, I believe that it would be a mistake to establish special clinics. It is the tuberculosis officer, familiar with the patient and his family, in touch with all measures of treatment, prevention and assistance, who should decide whether a child needs vaccinating and in what conditions.

The methods for the prevention of tuberculosis in childhood must therefore, in a general administrative way, depend on the country under consideration, the economic conditions of the population, the incidence of tuberculous disease, and the efficiency of the general anti-tuberculosis campaign. The same measures cannot be applied in Spain—with much poverty, a high tuberculosis mortality, and scarcely any sanatoria—as in Denmark, where the economic and educational level is very high, the tuberculosis mortality low, and sanatoria beds are so plentiful that no patient need ever wait for a bed, or in Paris with a relatively high natality amongst tuberculous adults, as in Oslo, where as the result of education and contraceptive teaching, not one infant is known to have been born of tuberculous parents during the last six months of 1934 (Brinckmann, private communication). Equally no golden rule can be laid down in each country in dealing with home-contacts ; each child must be considered individually. Which of, or whether all, the four main measures I have discussed—i.e. adequate treatment of patient, hygienic precautions in the home, removal of child to an institution or family, and B.C.G.—are applied, must depend on such factors as age, relationship of the tuberculous individual to the child, financial position of the family, whether there are suitable relatives to whom children can be sent, and so on.

In conclusion, I venture to make a plea for the home-contact, for a deeper realization of his danger, a more energetic study of his tuberculous infection and disease, and a wider application of the measures available in spite of our relative ignorance.

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Dr. Reginald Lightwood : It is generally agreed that the tuberculous infection is most deadly in early infancy, its lethality diminishing as age increases. The danger consists in a special tendency for miliary dissemination to occur in an infant a few weeks after its initial infection.

On account of this, Grancher devised his scheme for separating infants from tuberculous parents. On a smaller scale, at this time, the London County Council makes similar provision, and a scheme is in operation at Hastings.

So long as there is no other sure way of preventing infection at the age of greatest lethality, such a scheme for the separation of the infant from an infected parent is the only means open to us. Among its disadvantages must be reckoned its costliness and the natural dislike of parents to endure such separation, and also the fact that when the period of separation is over, a non-immune child then becomes—potentially at least—a contact.

In the opinion of Calmette, B.C.G. immunization *per os*, practised as in France in conjunction with the Grancher system, removed the last objection. In regard to

the immunity he claimed to establish, opponents of Calmette's contention have argued variously, denying it or questioning its duration and its uniformity. Latterly, most responsible opinions seem in agreement that B.C.G. properly prepared and properly administered, is harmless, and that when given *per os*, partial immunity is usually conferred. More knowledge is required as to the date of appearance of the immunity, and little is known at yet of its duration. So much for B.C.G. given by the oral route.

Immunization by intradermal vaccination with B.C.G.—A new position arises out of the work and results of Wallgren, who administers B.C.G. intradermally in Gothenberg. The immunity conferred by his methods appears to result in such a degree of resistance that among 230 infants vaccinated by him, and returning to tuberculous homes, no deaths from tuberculosis have occurred, while only one infant has shown unmistakable evidence of pulmonary tuberculosis, and this proved to be benign.

In addition, Wallgren has presented evidence that in his city the infant-mortality rate for tuberculosis has shown a striking fall since these intradermal vaccinations have been employed, and this has taken place in spite of the fact that the general tuberculosis death-rate has not shown the same downward tendency, and thus the number of sources of infection in that city has not, broadly speaking, decreased in proportion to the decrease in the number of deaths from tuberculosis in infants.

Of so great importance is Wallgren's work that it will be profitable to note the main points in which his practices differ from those of other users of B.C.G.

(1) No infant is selected for immunization until it is reasonably certain that it has not yet become infected. It is necessary, in order to prove this, to obtain a negative tuberculin reaction six weeks after the last contact with any possible source of tuberculosis.

(2) No infant is deemed to have been effectively immunized until a positive tuberculin reaction results from B.C.G. vaccination.

(3) Each and every case is followed up and subjected to clinical and radiological examination at intervals.

It may be asked whether any other workers have attempted vaccinations on similar lines. Kereszturi, William Park, Vogel, and Levine have followed about 1,000 contact children; some of these were controls, while others were vaccinated orally, subcutaneously or intracutaneously. The mortality from tuberculosis among their control group was found to be six times greater than in the vaccinated children. The comparative tuberculosis mortality rates for all the unvaccinated and all the vaccinated were 3% and 0·5% respectively. When two smaller groups, in which all were followed from birth and all exposed during the first year, were compared, it was found that the mortality from tuberculosis was 9·7% in the control group and 1·8% in the B.C.G. group. Two orally vaccinated children died of tuberculosis, but no child intradermally vaccinated so died.

From the author's figures, parenteral vaccination seems to confer a more complete immunity than does oral vaccination. Furthermore, it is to be noted that no infant immunized by the parenteral method in the Gothenberg or the New York schemes has died of tuberculosis.

The cost of intradermal vaccination.—From the point of view of the investigator, it is a fact that no clear-cut result can be shown unless the only infants studied are those known to be uninfected up to the time when their artificial immunity develops. This demands that infants selected for immunization must be negative tuberculin reactors, isolated from any openly tuberculous individual for six weeks before vaccination, and that they must not risk any such contact until they become positive reactors after vaccination. In most cases this necessitates the provision of institutional care for some twelve weeks, for which I have found the sum of at least £9 to be necessary.

Both on account of expense and for other reasons, immunization will, in my opinion, only be practised in the case of infants exposed to risk of pulmonary tuberculosis which risk cannot be indefinitely interrupted by separation. Such circumstances arise when a parent suffers from open, or potentially open, pulmonary tuberculosis. The adoption in such cases of B.C.G. vaccination is likely to prove an effective means of diminishing the incidence of tuberculous meningitis and miliary tuberculosis in infancy.

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Dr. Robert Carswell said that an equivocal reference had been made to the subcutaneous tuberculin test. In 1925 the Medical Research Council published a report by its Tuberculin Committee, in which one of the main objects of investigation was stated :—

" It is commonly accepted that a positive reaction in cattle to the subcutaneous tuberculin test implies infection with tuberculosis. In certain instances, however, in undoubted cases of tuberculosis in cattle, the reaction is either negative or doubtful. Are these discrepancies so numerous as to vitiate the general application of the test for practical purposes ? " [1]

The report did not fairly meet the question ; it concluded as follows :—

" The subcutaneous tuberculin test appears to be a perfectly satisfactory test for the presence of tuberculosis in cattle when carried out under the laboratory conditions of a scientific trial. It is not a satisfactory test when carried out under ordinary farm conditions : the discrepancies then prevailing are often so numerous as to vitiate the general application of the test for practical purposes." [2]

This was not the point. The real question was what was the scientific explanation of the discrepancies that had been reported by competent observers, and how were they to be reduced ? On these points the Report threw very little light, if any. On the other hand, the subcutaneous test had been involved in a certain amount of unmerited discredit.

Discrepancies had been reported by competent observers with both subcutaneous and intracutaneous tests, and would have to be accounted for. Nevertheless, the two tuberculin tests between them, repeated if necessary, and combined with sound technique and clinical experience, could be relied upon to furnish correct information in something not far short of 100%. Physicians were well armed for the detection of tuberculosis in its earliest stage.

When considering the problem of prophylaxis the usual division of tuberculosis into tuberculous infection, latent tuberculosis, and tuberculous disease, was open to the objection that it threw too much into the background the common histological basis. This was not the case in veterinary medicine. The owner of a tubercle-free herd did not need to discriminate nicely between these three classes. It was sufficient that an animal was a reactor for it to be dealt with in the light of the revealed fact—the presence of tuberculosis, much or little. In man a distinction was made, owing to the practical difficulty of discovering and eliminating small hidden tuberculous foci with certainty. Who would willingly tolerate the smallest tuberculous papule on the skin, once diagnosed, or hesitate to adopt the most painstaking measures to ensure its complete and permanent eradication ?

[1] *Med. Res. Coun. Sp. Rep. Series*, No. 94, p. 7.
[2] *Ibid.*, p. 116.

It was now becoming increasingly recognized that in the Koch preparations T.R. and B.E. we possessed agents of undoubted immunizing value. Whatever might be the exact degree and duration of this immunization, it was, at least, sufficient to aid materially in the elimination of slight or incipient tuberculosis. How far it would go towards eradication or control of more advanced disease was a matter for careful clinical and experimental work to demonstrate. Enough had been proved to give the foundation of a new and hopeful ideal and objective in human tuberculosis — *beginning with the young, establish and maintain an entirely tubercle-free population.*

In the *British Medical Journal* of October 16, 1926, clinical illustrations supporting this argument would be found, and in the same Journal for October 11, 1930, there was reported a good case of its deliberate accomplishment. The tubercle-free condition therein described had been maintained to date and could now be considered, in all probability, permanent. The conversion of reactor into permanent " ceased reactor " might be a troublesome and laborious process, but it was possible, it had been done; its spontaneous occurrence in cattle had been noted. Lawrason Brown had referred to it in his patients with satisfaction. The specific part of the process required much experience; it would be greatly aided by the best general conditions of treatment, and no doubt improvements would be forthcoming.

Prevention of infection so far as possible, early discovery and timely eradication, as above outlined, would ultimately solve the tuberculosis problem.

Dr. Leonard Findlay said that the few remarks which he proposed to make would have special reference to pulmonary tuberculosis and its prophylaxis in childhood.

For him the really important point in the discussion was not the frequency of the condition, but its hopelessness when it had once developed. Indeed, so far as the incidence was concerned there was much cause for optimism, since the death-rate from pulmonary tuberculosis during the first two years of life—undoubtedly the period, during childhood, of greatest incidence—was, in England and Wales, in 1929 only one-fifth of what it had been in 1911; whereas during the same period the mortality rate from the same cause in the adult between 25 and 45 years of age had only declined by 50%.

It should be appreciated that, so far as childhood was concerned, the greatest incidence of pulmonary tuberculosis was during the first two years of life. Pulmonary tuberculosis was not a disease of later childhood. Whether this fact was due to a greater susceptibility of the infant, or whether it was because association with the infected was more intimate at this age, he could not say, but at any rate it directed attention to the period of life in which prophylaxis should be concentrated.

As Dr. Miller had revealed, and as would be agreed by all having much experience, pulmonary tuberculosis in the child, and particularly in the infant, was almost invariably fatal. This view was supported by the post-mortem material collected at the Royal Hospital for Sick Children, Glasgow, by Dr. Blacklock, who during the course of 1,500 examinations found evidence of pulmonary tuberculosis in process of healing in only three instances. Completely healed tubercle in the lung he did not encounter. This to him (Dr. Findlay) seemed a most significant finding.

It was from facts such as these that he felt that the only safeguard was prevention. The child should be removed from all risk of contact with an infected person. This removal had not, so far as he knew, been carried out systematically in this country, but in France and Canada it had been the practice for many years. Everybody would admit that it would be a great advantage if the resistance to infection by the tubercle bacillus could be increased, especially during the first two particularly susceptible years of life. And this seemed to be made possible by use of the B.C.G. vaccine. It was now four years since the late Professor Calmette had

visited London on the invitation of the Section for the Study of Disease in Children, and related his great experience of this prophylactic measure. Members had just heard from Dr. Kayne the result of his investigations in different centres, and Dr. Lightwood had told them of the good results obtained by Dr. Wallgren of Sweden with this measure. It must also be recalled that last year Irvine had published a volume summarizing, for the English-reading medical public, all the available evidence on the use of the B.C.G. vaccine. From a study of all this evidence it would appear that the administration of the B.C.G. in man was free from all danger and that it did induce a certain degree of immunity. Hence he suggested that the period of discussion had passed, and that the time was ripe for action in this country by emulating what had been found of real value in most others.

Dr. Veitch Clark (President of the Society of Medical Officers of Health) said that much of what had been said in the discussion had no relation to prophylactic measures. It would be more directly practical to concentrate upon the results of measures which had been tried. He agreed with Dr. Powell's delightful attack on disinfection generally, but there were some diseases in respect of which disinfection could not safely be dispensed with, and tuberculosis was one of them. There had been such abundant proof of the viability of the tubercle bacillus under all sorts of conditions and in all circumstances, that any local authority which, in its anti-tuberculosis scheme, neglected disinfection, could be charged with failing in its duty. He regarded it as an essential part of all communal prophylaxis against the disease. He felt that if the only tuberculous people were those who were thoroughly trained in sanatorium régime and carried the principles into home life, very little risk of infection would exist in the country. But when, as he could easily show was the case, there were hundreds of tuberculous persons, in the lowest stratum of life, moving about and broadcasting their infection, only those who had no contact with such people and their conditions could advocate the abolition of antiseptic measures.

Another point in which he had been interested was the reference, by several speakers, to the Grancher system. It was necessary to look at these things with a certain degree of mental balance. One should regard tuberculosis or any other disease not only as a medical specialty, but also as something which was occurring in ordinary human life. When it was realized that the incidence of tuberculosis had diminished 50 per cent. during the last thirty or forty years, it was pertinent to ask whether there was justification for such interference with family life as was implied in the Grancher system. Possibly the communal care of children might come to pass in this country, as it existed at present in the Soviet Republic, but he did not feel sure that the nation would benefit from such a measure. It was necessary to think of things, not only in the scientific but also in the human—the social—sense, and in regard to the Grancher system he had always been impressed by the lack of appreciation of the home element. Scientifically it might be ideal, but domestically he feared it was impossible as a system. He had not seen the data regarding its application, but he believed that in the countries where it was tried it was, in proportion to the total population, no more than a drop in the ocean. He believed that the diminution in tuberculosis which had occurred—and he was not decrying any efforts which were being made, as he was a strong supporter of all that was done in that direction—was as much due to general measures of improved hygiene as to specific measures directed against tuberculosis itself. The anti-tuberculosis schemes were, in his view, of enormous value, and he would not say a word of detraction concerning the sanatorium régime and the control of infection in the home. It was true that, as a general rule, tuberculosis

was handed on from person to person, but he thought that improvement in the working conditions of the people, improvement in their houses and in their general dietetic possibilites—in fact a bettering of the whole environmental conditions in their daily lives—had been the most potent factor in the reduction in the incidence and the mortality of the disease.

He pleaded for a balanced consideration of all the conditions, for the social and other aspects were as important as the scientific.

Sir Leonard Rogers said that during his twenty years' service as pathologist in the largest hospital in India, his attention had been strongly directed to tuberculosis, because in five thousand post-mortem examinations which he had analysed it was the cause of more deaths than any single tropical disease. In 17 % of his entire autopsies the cause of death was tuberculosis, and in a further 5 % it was a contributor to the death in association with other diseases. An important reason for that heavy toll had already been mentioned in the discussion, namely infection, for in the large towns in India most of the Hindus lived on the joint-family system. Several generations, including, sometimes, scores of people, lived in one large barrack-like house, and before one patient died of phthisis, he had usually infected several others. Mohammedan women suffered from the disease twice as much as did Hindu males, owing to the purdah system.

With regard to pathology, a number of his cases were instances of primary intestinal tuberculosis. In these there were enlarged caseous abdominal glands and no disease of the lungs. A very important point was that there was practically no bovine tuberculosis in the people of India, for not 0·5% of cattle showed tuberculosis. In some of those cases he had tried inoculating animals, but had never obtained evidence of bovine infection in the intestinal cases. In India the streets were swept before they were watered, and the milk was carried from door to door in open cans. People expectorated in the streets and when this material dried it was carried into the milk. That was one reason for the preponderance of the human form of tuberculosis which presented a very serious problem in India.

Dr. E. Stolkind said that it was interesting to compare what had sometimes been done in remote times in the matter of prophylaxis against tuberculosis with what was done now in England.

In 1699, the General Council of the Republic of Lucca, Italy, published a decree making notification of cases of tuberculosis and disinfection of the house after death obligatory under penalty of a fine or of prison. In Naples (1782), for a similar offence the penalty was three years' hard labour for common people or a 300-ducats fine for nobility. In Florence, in the year 1754, on the advice of Professor A. Cocchi, a decree was published prohibiting spitting on the floors or the streets ; spitting had to be into glass bottles only. Cocchi also insisted that every tuberculous patient should have a separate large room, facing either south or east, that in winter windows should be open, and that the clothes and linen—especially the bed-linen—should be washed frequently [1].

It was now agreed that the prophylaxis of tuberculosis was mainly dependent on social conditions, especially housing and proper nutrition and education of the people. From his study of the campaigns against tuberculosis here and abroad, he, the speaker, had found that the social conditions in England were much better than in any other country. Yet even here there were still many things requiring attention, in particular the segregation—at all costs—of tuberculous persons.

The housing conditions in many places were still unsatisfactory and insanitary.

According to the Census of 1931, in England and Wales (out of a population of 39,947,931) 331 thousand persons still lived four or more per room. Thousands of families lived at densities of from 6 to 11 persons per room. In greater London alone there were 187,181 persons with one room for more than three individuals. In Islington there were 226 families living six or more in one room. A number of people slept four or more in one bed. Unfortunately, the contagious tuberculous persons had to share not only their rooms but also their beds with several healthy ones. For instance, in Hull in 1928 out of 559 investigated cases of active pulmonary tuberculosis 134 had to share their bed with one, and 34 with two or three healthy persons; the mortality and morbidity from pulmonary tuberculosis among some sections of workmen, e.g. scissor grinders, was appalling. In Lancashire out of 1,865 investigated patients with active pulmonary tuberculosis, 430 had a bed for themselves but shared the room with other persons, and 178 contagious patients shared their beds with several healthy persons. In Jarrow, a town with a population of 32,000, in 1929-30, among 568 tuberculous families there was, according to Bradbury [2], overcrowding in 308; 181 with three persons per room and 127 families with three or more persons per room; 60 families with four per room and 56 with five per room.

Of these tuberculous families 339 received unemployment benefit, 261 were found to be undernourished, 217 lived in insanitary dwellings.

Something must be done by the State and the people to fight these dangerous conditions. Since 1908 he (the speaker) had advocated " Homes for sufferers from chest diseases " (day or night sanatoria) where a tuberculous person could remain either at night or during the day, or both. In these Homes, which would be linked up with dispensaries and sanatoria, the patients should receive open-air treatment, proper nutrition, and sanatorium education. The Homes should be situated so as to be suited for open air treatment. It would not be difficult to find houses with gardens and adapt them to this purpose by adding verandas, balconies, or shelters. At first, if no shelters could be provided for those who came during the day, rugs, umbrellas and resting chairs might be sufficient. The cost per patient per day in such a home would be about two shillings.

To make a success of the fight against tuberculosis, the scale on which the propaganda was made must be enlarged. People must be taught to realize that tuberculosis was contagious and did not spare its contacts, even in palaces, where it might spread from the consumptives in overcrowded dwellings. For instance, the heir-apparent of the Tsar Alexander III and some Russian Tsarinas had died from pulmonary tuberculosis. Such propaganda would bring forth money from the State, local authorities and the community. This money, which was so important for prophylactic measures against tuberculosis, for improvement of the social conditions, strengthening the health of the contacts, especially of the children and youth, would also make it possible to provide isolation or a separate room in a larger house for contagious tuberculous patients.

Many patients would go voluntarily to special institutions—sanatoria, special homes, &c., if they could be sure that their families would be adequately supported. At present many workmen could not afford to be certified as tuberculous, as they were afraid of losing their job, and so they worked until the last weeks of their life. Diagnosis was then made too late and the disease in the meantime had spread. At present there was not enough facility for early or correct diagnosis.

The official figures of morbidity and mortality from pulmonary tuberculosis were certainly not complete. There was no doubt that, e.g. in 1933 the certified deaths from bronchitis (15,260), pneumonia (30,059), influenza with respiratory complications (16,987) and other diseases of the respiratory organs included a number who suffered from pulmonary tuberculosis.

As about 50 per cent. of the English dairy herds were affected with tuberculosis and raw milk was the most common carrier of bovine tubercle bacilli to man, people should be taught to use only sterilized, or properly and sufficiently pasteurized, milk.

References.—1 E. STOLKIND, " Campaign against tuberculosis in Italy " (*In Russian*). 2 BRADBURY, "Causal factors in tuberculosis," 1933, London.

Dr. R. C. Jewesbury (President of the Section for the Study of Disease in Children) said it seemed to him, as to Dr. Veitch Clark, that the discussion had tended to deal with the spread of the disease rather than with what might be done in the way of prophylaxis (the notified subject).

He was interested in child welfare work, and would like to know what one ought to do when a tuberculous mother came to him with her child. He quite realized, as several had said in the discussion, that the proper thing to do was to separate the child from its mother. It sounded such an easy course, but his experience had shown him that in most instances it was very difficult. The mother, naturally, raised all sorts of objections and was unable to understand its necessity. Even if it was agreed to, who was to look after the child ? There was no Grancher system in this country, and if there were, it was questionable how far it would be successful.

Then there was the question of conferring artificial immunity by vaccination of the child. He agreed with Dr. Leonard Findlay that this was a method which, so far, had practically been ignored in this country. He did not think that it should be thus ignored. If the facts and figures given by Calmette and his co-workers were accepted, surely a strong case had been made out for a trial in this country. But, here again, how was it to be carried out ? He supposed that the permission of parents would have to be obtained before their children could be submitted to intradermal inoculation, or even to oral administration of the vaccine. From what had been said it seemed that the first method was much the more efficacious. He appreciated the difficulties in actually employing the B.C.G. methods, but he felt that efforts should be made to overcome them. Much depended on the doctors ; if the medical men could present a reasonable case to the public and assure them that they had a valuable and safe means of prevention, then the public, by degrees, would probably come to agree with it. He supposed that, sooner or later nearly every child became infected with tuberculosis, though, fortunately, the majority of infections were benign. It would be very valuable if something could be done to protect the child during the period of its life when it was most susceptible to tuberculous infection, for then it might carry on and fight its own battle against the disease. As a practical result of this discussion, therefore, he hoped that a systematic trial of the B.C.G. method would be made in this country.

Dr. MacNalty (in reply) said that one or two speakers had said that the Grancher system was not being used in this country, but he wished to point out that a modification of that system was used by the London County Council. There was also a scheme of the kind at Hastings. He was sure, however, that the most satisfactory way of dealing with the problem and of maintaining family life was the segregation of the infectious case —with which Dr. Powell had dealt— rather than the removal of the child from its home.

With regard to B.C.G., the profession in this country had not been so much behind-hand as Dr. Jewesbury feared. When Calmette first announced this discovery a special Committee of the Medical Research Council was formed for the purpose of studying it, and some would remember Professor Major Greenwood's criticism of the statistics. The difficulty, of course, was, as Dr. Jewesbury had said, that many people did not like their young children to be given any form of vaccine treatment. Professor Cummins offered it in Wales, but had only succeeded in getting a limited number of mothers to consent even to oral administration.

The immunity conferred appeared to be transient. Dr. Stanley Griffith's report on B.C.G. to the Medical Research Council showed that monkeys so treated exhibited little or no immunity. These considerations made many workers hesitate to advise the use of B.C.G. on a large scale in this country. But the problem was being kept under review by the Ministry of Health and the Medical Research Council.

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